Table E-2. Biological Data for Plante Ferry Rainbow Trout Gut Content Specimens.

Gut Content Sample No.	Field ID	Date Collected	Total Length (mm)	Fork Length (mm)	Weight (g)	Gut Contents (g)*	Sex	Age (yrs)
188311	PF4	9/15/03	385	363	551		F	3
	PF5		410	387	670	7	F	4
	PF6		404	387	640	1	M	nd
	PF8		365	350	552	15	M	nd
	PF11		407	394	714	1	M	4
	PF13		388	369	585	9	F	3
	PF14		359	342	454	5	Imm. M?	3
	PF15		323	308	363	1	M	3
	PF16		300	284	291	4	M	2
	PF17		380	364	582	3	M	3
	PF18		422	401	782	19	M	3
	PF19		412	385	667	12	F	4
	PF20		427	408	760	11	F	3
	PF21		376	356	583	14	F	3
	PF22		387	366	560	nm	F	4
	PF23		345	328	452	1	Imm. M?	2
	PF24		378	359	517	nm	F	3
	PF25		401	387	663	empty	F	3
	PF26		345	325	427	nm	F	2
	PF27		321	301	332	nm	Imm. M?	2
		Mean=	**373**	**355**	**546**			**3**

* Total sample weight = 16 g.

Table E-3. Biological Data for Ninemile Rainbow Trout Fillet Specimens.

Fillet Sample No.	Field ID	Date Collected	Total Length (mm)	Fork Length (mm)	Weight (g)	Lipids (%)	Sex	Age (yrs)	Origin
084281	NM1	9/16/03	334	321	413	1.5	Imm. M?	1	hatchery
084282	NM2		357	340	454	2.6	F	2	wild
084283	NM3		320	307	306	1.3	Imm. M?	1	hatchery
084284	NM4		308	290	306	1.9	M	1	wild
084285	NM5		350	332	471	1.1	F	3	wild
084286	NM6		300	282	289	1.0	Imm. M?	1	hatchery
084287	NM7		290	272	290	0.4	Imm. M?	1	hatchery
084288	NM8		333	321	425	1.9	M	1	hatchery
084289	NM9		377	365	483	0.7	F	3	wild
084290	NM10		328	315	380	3.3	M	3	wild
084291	NM11		333	316	376	2.5	F	3	wild
084292	NM12		342	325	421	2.0	Imm. M?	1	hatchery
084293	NM13		296	281	266	1.8	Imm. M?	1	wild
084294	NM14		289	273	257	1.0	M	1	hatchery
084295	NM15		283	273	268	0.6	Imm. M?	1	hatchery
084296	NM16		295	280	251	0.4	Imm. M?	1	hatchery
084298	NM18		296	285	320	0.9	M	1	hatchery
084299	NM19		275	261	227	0.2	Imm. M?	1	hatchery
084301	NM21		297	282	255	1.5	Imm. M?	1	wild
084302	NM22		282	269	250	0.8	Imm. M?	1	hatchery
084303	NM23		362	352	503	0.9	F	2	wild
084304	NM24		265	251	231	0.3	Imm. M?	1	hatchery
084305	NM25		286	270	244	0.5	Imm. M?	1	hatchery
084306	NM26		268	252	201	1.6	M	1	wild
		Mean=	**311**	**296**	**329**	**1.3**		**1**	

Table E-4. Biological Data for Ninemile Rainbow Trout Gut Content Specimens.

Gut Content Sample No.	Field ID	Date Collected	Total Length (mm)	Fork Length (mm)	Weight (g)	Gut Contents (g)*	Sex	Age (yrs)
188310	NM3	9/16/03	320	307	306	1	Imm. M?	1
	NM5		350	332	471	2	F	3
	NM6		300	282	289	4	Imm. M?	1
	NM9		377	365	483	1	F	3
	NM11		333	316	376	1	F	3
	NM13		296	281	266	3	Imm. M?	1
	NM14		289	273	257	5	M	1
	NM17		260	245	190	1	Imm. M?	
	NM18		296	285	320	5	Imm. M?	1
	NM19		275	261	227	5	Imm. M?	1
	NM23		362	352	503	2	F	2
	NM25		286	270	244	2	Imm. M?	1
	NM26		268	252	201	1	M	1
		Mean=	**309**	**294**	**318**			**2**

* Total sample weight = 22 g.

Table E-5. Biological Data for Stateline Largescale Sucker Whole Body Analysis Specimens.

Whole Body Sample No.	Field ID	Date Collected	Total Length (mm)	Weight (g)	Age (yrs)
328442	SL-5	7/14/04	556	1584	13
	SL-6		566	1618	18
	SL-7		483	984	11
	SL-8		521	1168	13
	SL-12		492	1070	8
	SL-15		499	1028	10
	SL-16		476	979	8
		Mean=	**513**	**1204**	**12**
328443	SL-4	9/17/03	460	909	9
	SL-9	7/14/04	459	940	11
	SL-10		457	973	11
	SL-11		427	707	7
	SL-13		433	765	7
	SL-14		471	868	9
	SL-17		408	731	6
		Mean=	**445**	**842**	**9**

Table E-6. Biological Data for Plante Ferry Largescale Sucker Whole Body Analysis Specimens.

Whole Body Sample No.	Field ID	Date Collected	Total Length (mm)	Weight (g)	Age (yrs)
328440	PF-32	9/15/03	463	1093	10
	PF-33		515	1325	8
	PF-38		458	1099	8
	PF-40		485	1117	7
	PF-42		502	1210	7
	PF-43		465	1061	7
	PF-46		440	981	6
	PF-47		501	1250	9
	PF-50		476	1095	9
	PF-51		489	1097	8
		Mean=	**479**	**1133**	**8**
328441	PF-28	9/15/03	475	1094	11
	PF-31		454	1082	8
	PF-35		477	992	7
	PF-36		435	903	5
	PF-41		416	797	6
	PF-48		433	800	7
	PF-49		442	843	9
	PF-52		454	1127	7
	PF-53		460	1043	8
	PF-54		482	963	7
		Mean=	**453**	**964**	**8**

Table E-7. Biological Data for Plante Ferry Largescale Sucker Gut Content Specimens.

Gut Content Sample No.	Field ID	Date Collected	Total Length (mm)	Weight (g)	Gut Contents (g)*	Age (yrs)
328445	PF-29	9/15/03	443	775	5	8
	PF-34		506	1205	17	10
	PF-37		460	893	8	9
	PF-39		424	704	2	6
	PF-44		532	1599	12	10
	PF-45		544	1379	9	8
		Mean=	**485**	**1093**		**9**

* Total sample weight = 53 g.

Table E-8. Biological Data for Ninemile Bridgelip Sucker Whole Body Analysis Specimens.

Whole Body Sample No.	Field ID	Date Collected	Total Length (mm)	Weight (g)	Age (yrs)
328447/8	NM-31	7/13/04	475	980	15
	NM-33		414	820	6
	NM-34		442	693	10
	NM-40		432	881	7
	NM-41		406	673	9
	NM-47		427	616	9
	NM-51		421	826	8
		Mean=	**431**	**784**	**9**
328450	NM-36	7/13/04	358	466	5
	NM-42		356	468	5
	NM-43		351	476	5
	NM-44		358	511	6
	NM-48		355	426	6
	NM-49		357	486	6
	NM-50		351	460	5
		Mean=	**355**	**470**	**5**

Table E-9. Biological Data for Ninemile Bridgelip Sucker Gut Content Specimens.

Gut Content Sample No.	Field ID	Date Collected	Total Length (mm)	Weight (g)	Gut Contents (g)*	Age (yrs)
328449	NM-32	7/13/04	393	695	3	5
	NM-35		401	631	8	5
	NM-37		411	665	6	7
	NM-38		408	732	16	6
	NM-39		408	626	4	6
	NM-45		366	533	6	6
	NM-46		385	536	12	7
		Mean=	**396**	**631**		**6**

* Total sample weight = 55 g.

Table E-10. Biological Data for Lake Spokane Largescale Sucker Whole Body Analysis Specimens.

Whole Body Sample No.	Field ID	Date Collected	Total Length (mm)	Weight (g)	Age (yrs)
328444	LL-2	7/13-14/2004	463	950	10
	LL-7		475	897	10
	LL-14		458	1155	11
	LL-17		445	1003	7
	LL-18		444	897	7
	LL-19		457	934	6
	LL-21		501	1335	9
	LL-23		466	986	5
	LL-24		473	1004	9
	LL-25		450	966	8
		Mean=	**463**	**1013**	**8**
328446	LL-1	7/13-14/2004	440	733	8
	LL-4		425	707	7
	LL-5		439	895	8
	LL-9		416	742	8
	LL-10		433	950	8
	LL-11		442	881	9
	LL-15		439	856	6
	LL-16		458	939	11
	LL-20		415	700	6
	LL-22		425	799	5
		Mean=	**433**	**820**	**8**

Table E-11. Biological Data for Crayfish Tail Muscle Analysis Specimens.

Sample No.	Field ID	Carapace Length (mm)	Date Collected	Weight (g)	Tail Muscle Weight (g)	Sex
208148	1	37	5/12-13/2004	41	5	F
	2	42		53	5	M
	3	39		53	4	M
	4	36		46	4	M

Appendix F: Fish Tissue Preparation, 2003-2005

Whole Body

Suckers for whole body analysis were prepared by removing them from the freezer and allowing them to partially thaw. Plans to composite specimens by sex were abandoned after numerous specimens were opened and gonads were either not found or of indeterminate type. As an alternative, specimens were grouped by length to form a small composite sample and a large composite sample, although size did not vary appreciably among fish. This allowed composites to be formed according to EPA recommendations where the smallest fish in the composite was at least 75% of the length of the largest fish (EPA, 2000a).

Scales and opercula were removed from suckers and mounted or stored for subsequent aging according to Washington Department of Fish and Wildlife (WDFW) protocols. The partially thawed fish were chopped or sawed into pieces on aluminum foil, then ground one at a time in a Hobart commercial meat grinder. After each individual was ground, tissue was mixed well using a stainless steel bowl and spoon. A 50 g aliquot from each specimen was combined to form the composite samples. The combined tissue was then passed twice more through the grinder and thoroughly mixed after each pass.

Composites of Plante Ferry and Lake Spokane suckers consisted of ten specimens each, and composites of Stateline and Ninemile suckers were made from seven specimens each. Homogenized tissue was placed in an appropriate sample container and returned to -20ºC until analysis.

Fillet

Rainbow trout fillets were prepared by removing specimens from the freezer and allowing them to partially thaw. Scales and otoliths were removed and mounted or stored for subsequent aging according to WDFW protocols. Specimens were scaled, rinsed with deionized water, and sex was determined by visual inspection of gonads.

Plante Ferry rainbow trout were prepared as ten-fish composite samples, grouped by sex. Ninemile rainbow trout were analyzed individually. Tissue was prepared by removing a skin-on fillet from one side of the fish while on aluminum foil. Composite samples were formed in the same manner as described for whole body samples except that a Kitchen Aid® food processor was used to homogenize tissue rather than a Hobart grinder. Homogenized tissue was placed in an appropriate sample container and returned to -20ºC until analysis.

Gut Contents

Gut contents were obtained from suckers other than those used for whole body analysis and from rainbow trout used for fillet samples. Thawed specimens were opened, and the entire gastrointestinal tract was removed, rinsed with deionized water, gently patted dry with a paper towel, and the contents of the stomach was extruded into a pre-cleaned glass jar. In some cases, rainbow trout stomach contents could only be obtained by slicing open the stomach wall and removing the contents. For suckers, the gut did not have distinctive anatomical components (stomach, intestine), were extremely long (approximately 3 m), and narrow. Therefore, contents from the upper half of the gut were removed for analysis.

Once removed, gut contents were weighed and visual observations were made. Approximately one-half of the rainbow trout had large masses of filamentous plant material in the stomach. In these cases, bugs, mucous bolus, or other food-like material was extracted, and plant material was discarded. Entire gut contents from each specimen were combined for a composite sample, since total mass of material was small and near the minimum amount of material required for analysis. Several grams of material from each species were placed in 20% formalin for subsequent stereoscopic evaluation. The remainder of the collected material was frozen at -20ºC until analysis.

Crayfish Tail Muscle

Crayfish (*Pacifastacus leniusculus*) collected from Upriver Dam were allowed to partially thaw. Sex was determined and the entire tail muscle (4-5 g) was removed from the exoskeleton. All tissue from the four specimens obtained were placed together in a pre-cleaned jar, finely chopped and mixed using a clean scalpel, and frozen at -20ºC until analysis.

Equipment Cleaning

Prior to sampling, all sampling implements and equipment were cleaned by sequentially:

1. Washing in Liquinox detergent and hot tap water.
2. Rinsing with hot tap water.
3. Rinsing with deionized water.
4. Rinsing with pesticide grade acetone.
5. Air-drying.
6. Rinsing with pesticide grade hexane.
7. Air drying.

After drying, equipment was wrapped in aluminum foil (dull side in) until used in the field. Sampling equipment was dedicated to each station or each sample. Fish processing and tissue homogenization equipment was cleaned between each sample using the described procedure. Persons preparing tissue samples wore non-talc polyethylene or nitrile gloves and worked on aluminum foil. Gloves and foil were changed between samples.

All sample containers were pre-cleaned according to EPA (1990) quality assurance/quality control specification. Samples for PCB analysis were placed in glass jars with Teflon-lined lids. All samples were cooled on ice immediately after collection and transported under chain-of-custody protocols.

Appendix G: Results on Quality Control Samples for 2003-2005

Results of quality control samples analyzed to estimate precision and accuracy are shown in Tables G-1- G-3. Laboratory duplicate analysis of PCB congeners and Aroclors show generally good precision, with relative percent differences (RPDs), the difference as a percentage of the mean, less than 20% when detected.

Equation: $$\boldsymbol{RPD = \left(\frac{difference\ of\ 2\ results}{mean}\right) \times 100}$$

Table G-1. Precision of Laboratory Duplicates (Mean RPD of Individual PCB Congeners or Aroclors*).

Station	Sample type	Sample number	RPD
Harvard	Surface water	3438100	ND
LIBLAKE	Water (effluent)	4064113	ND
Litlfls	Sediment	3454113	19%
LONGUP2 *		4268384	8%
Spokane-F	Tissue fillet	03084282	5%

ND: not detected at the reporting limit.

Precision of field replicates, which integrates environmental, sampling, and laboratory variability, is shown in Table G-2. Results show that there is substantial variability in SPMD results (average RPD of 28%). Other matrices show lower variability and can be largely accounted for by variation in laboratory analysis.

Table G-2. Precision of Field Replicates (Mean RPD of Individual PCB Congeners).

Station	Sample type	Sample number	Replicate sample number	RPD
Upriver Dam	SPMD	3474156	3474157	9%
		4194131	4194132	55%
UPRIVER BOT		4208136	4208137	20%
LitlSpokR		3474162	3474163	26%
LitlSpokBr		4194136	4194137	25%
		4208140	4208141	35%
SPOKWWTP	Water (effluent)	4188204	4188206	6%
KaiserEff		4064105	4064106	ND
NINEMILE-F	Tissue fillet	4324447	4324448	8%
Spokane-F		3084282	3084308	20%
LongLkLow	Sediment	3454112	3454114	20%

ND: not detected at the reporting limit.

Replicate samples for conventional parameters showed little variation in most cases (Table G-3). Instances of high RPD results were due to small absolute differences at low concentrations which have the effect of amplifying RPDs.

Table G-3. Precision of Field Replicates for Conventional Analytes.

Station	Sample type	Parameter	Sample number	Replicate sample number	RPD
Ninemile 1	Surface water	TOC DOC TSS	4058115	4058114	0% 17% 0%
PLANTEFRY		TOC DOC TSS	3448102	3448101	0% 0% 100%
Upriver Dam		TOC DOC TSS	4208136	4208135	0% 10% 0%
Harvard		TOC TSS	3438103	3438102	9% 0%
Upriver Dam		TOC DOC	3408967	3408972	22% 8%
NINEM SPM		TSS	3454107	3454106	0%
Upriver Dam		TOC DOC	4094045	4094044	15% 0%
		TOC DOC TSS	4164043	4164042	12% 18% 0%
SPOKWWTP	Water (effluent)	TSS	4188204	4188206	18%
KaiserEff		TSS	4064105	4064106	0%
LongLkLow	Sediment	Grain size TOC % solids	3454112	3454114	8%* 0% 1%
NINEMILE-F	Tissue fillet	% Lipids	4324447	4324448	8%

*Mean RPD of individual size fractions.

Accuracy of the PCB congener data in sediments was assessed through analysis of the National Institute of Standards & Technology (NIST) standard reference material (SRM) 1944 - New York/New Jersey Waterway Sediment. Results are shown for 12 of the 25 PCB congeners for which SRM 1944 is certified; other individual congeners in SRM 1944 match co-eluting congeners reported by Pace and were not compared (Table G-5). Five of the 12 congeners were within the 95% confidence level of the certified values. Other results were 20%-25% below the certified value, suggesting a low bias for PCB congener results in sediments.

Table H-5. Analysis of NIST 1944 Standard Reference Material (New York – New Jersey Waterway Sediment) by Pace Analytical Services, Inc. (ng/g, dw).

Analyte	Certified concentrations*	Pace Result	% Difference from mean
PCB-008	22.3. ± 2.3.	23.4	5%
PCB-031	78.7. ± 1.6	77.6	-1%
PCB-052	79.4. ± 2.0	80.3	1%
PCB-066	71.9 ± 4.3	57.1	-21%
PCB-095	65.0 ± 8.9	48.1	-26%
PCB-099	37.5 ± 2.4	29.7	-21%
PCB-105	24.5 ± 1.1	23.5	-4%
PCB-118	58.0 ± 4.3	52.9	-9%
PCB-194	11.2 ± 1.4	9.35	-17%
PCB-195	3.75 ± 0.39	3.91	4%
PCB-206	9.21 ± 0.51	7.09	-23%
PCB-209	6.81 ± 0.33	5.43	-20%

*Mean and range of 95% confidence levels.
Shading: Outside certified range of values.

Appendix H: Details of Arnot-Gobas Food Web Bioaccumulation Model

Overview of Arnot-Gobas Food Web Bioaccumulation Model

Models to track hydrophobic organic chemicals through the food web have increased in their accuracy and complexity as investigators have built upon previous models to make iterative improvements. One of the most recently available models, the food web bioaccumulation model developed by Arnot and Gobas (2004), was selected for the present study for several reasons:

1. The model was built upon a widely accepted kinetic model developed to predict bioaccumulation of hydrophobic organic compounds in the food web of Lake Ontario and other lakes (Gobas, 1993).
2. The model is programmed in Excel spreadsheets and is simple to use, make adjustments, and perform backward calculations (find values for input parameters needed to derive a defined model output).
3. Validation runs indicated the model could predict PCB concentrations in at least two Spokane River fish species with a fairly high degree of accuracy.

The model accounts for major routes of PCB accumulation through diet and the gills, while depuration occurs through elimination by the gills and feces and by metabolic transformation (Figure H-1). The model also accounts for decreases in contaminant concentration through growth dilution.

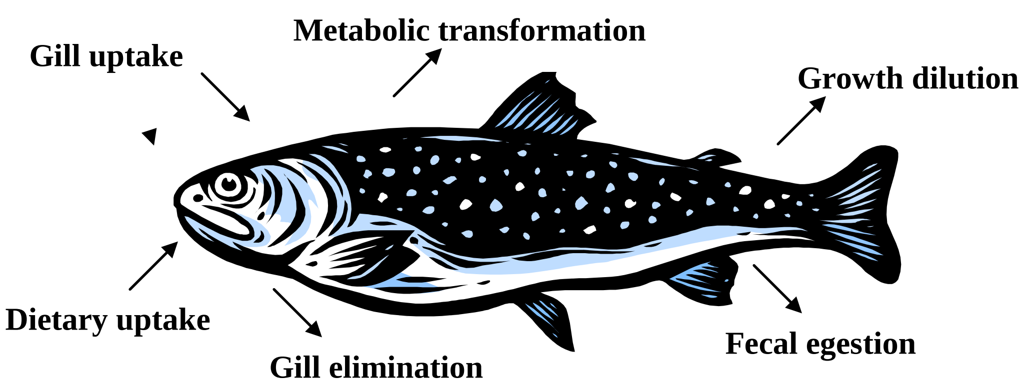


Figure H-1. Conceptual Diagram of the Major Routes of Contaminant Uptake and Depuration (Adapted from Arnot and Gobas, 2004).

The basic equation which describes the general model is:

$$dM_B/d_t = \left\{ W_B \bullet \left(k_1 \bullet [m_o \bullet \Phi \bullet C_{wT,0} + m_p \bullet C_{wD,S}] + K_D \bullet \Sigma(P_i \bullet C_{d,i}) \right) \right\} - (k_2 + k_E + k_M) \bullet M_B$$

Where:

M_B = mass of the chemical in the organism (g)
t = time (d)
dM_B/d_t = net flux of chemical in the organism at any point in time
W_B = weight of the organism at t (kg)
k_1 = clearance rate constant for the chemical uptake via gills and skin (L/kg • d)
M_o = fraction of respiratory ventilation in overlying water
M_p = fraction of respiratory ventilation in pore water
Φ = fraction of total chemical concentration that is freely dissolved in overlying water
$C_{wT,0}$ = total chemical concentration in water above sediments (g/L)
$C_{wD,S}$ = chemical concentration freely dissolved in pore water (g/L)
K_D = clearance rate constant for the chemical uptake via diet (kg/kg • d)
P_i = fraction of diet consisting of prey item i
$C_{d,i}$ = chemical concentration in prey item i (g/kg)
k_2 = rate constant for the chemical elimination via gills and skin (d^{-1})
k_E = rate constant for the chemical elimination via fecal egestion (d^{-1})
k_M = rate constant for metabolic transformation of the chemical (d^{-1})

The general equation can be simplified by assuming steady-state conditions (i.e., $dM_B/d_t = 0$), which results in a re-expression of the equation to:

$$C_B = \left\{ k_1 \bullet \left(m_o \bullet \Phi \bullet C_{wT,0} + m_p \bullet C_{wD,S}) + K_D \bullet \Sigma(P_i \bullet C_{d,i}) \right) \right\} / (k_2 + k_E + k_M + k_G)$$

Where:

C_B = chemical concentration in the organism (M_B/W_B)

The steady-state assumption necessitates a growth dilution term (k_G) which can be represented by a constant fraction of the organism's body weight. The reader is referred to Arnot and Gobas (2004) for detailed explanations of the sub-models used to derive all of the terms in the general equation. Assumptions and input parameters used to apply the model to the Spokane River are discussed below. All other environmental characteristics were those used for Lake Erie modeling and were supplied by J. Arnot.

Environmental characteristics

Environmental characteristic input parameters for the Spokane River model included mean annual water temperature, DOC, TSS, particulate organic carbon (POC), and sediment TOC. Table H-1 shows the values used. Mean annual temperatures, DOC, and TSS were mean values of the reaches modeled from data collected during SPMD deployment and recovery. One-half the detection limits were used for non-detects. Since January-February data for temperature were lost at Ninemile, the Monroe-Ninemile model was run using mean temperature data only from Monroe St. POC was calculated as the fraction organic carbon (f_{oc}) in suspended particulate matter (0.15, see Eq. 3) multiplied by TSS.

Table H-1. Input Parameters for the Arnot-Gobas Food Web Bioaccumulation Model.

	Reach				
	Stateline-Upriver	Monroe-Ninemile	Long Lake	Little Falls	Spokane Arm
Water					
Mean annual water temperature (°C)	9.2	8.9	10.0	10.0	10.0
DOC (mg/L)	1.2	1.0	1.1	1.1	1.1
TSS (mg/L)	1.6	2. 2	2.8	2.8	2.8
Particulate organic carbon (mg/L)	0.24	0.33	0.42	0.42	0.42
Sediment					
TOC (%)	2.0	1.6	2.9	0.6	1.7
Zooplankton					
Diet	100% phytoplankton				
Benthic Species					
Diet	50% phytoplankton, 50% sediment				
Rainbow Trout					
Weight (kg)	0.5				
Lipid (%)	5.6				
Diet	50% zooplankton, 12.5% each may-fly larvae, chironomid larvae, *Gammarus*, crayfish				
Sucker					
Weight (kg)	0.918				
Lipid (%)	3.8				
Diet	33% phytoplankton, 33% chironomids, 34% sediment		50% chironomids, 50% sediment		
Chemical (Total PCBs)					
Log K_{ow}	6.4				
Henry's Law Constant (Pa. m^3/mol)	3.9				

OC = organic carbon.
Pa = Pascals

Sediment TOC concentrations were more difficult to estimate due to lack of depositional material in the upstream reaches. For the Stateline-Upriver model run, the TOC was the mean of five sediments from RM 81.5-94.8 analyzed by Ecology (1994). Sediments from the Upriver Dam PCB "hot spot" were not used to derive this value. For the Monroe-Ninemile model run, the TOC value was the mean TOC of five Monroe St. (RM 74.9-78.7) sediments collected during 1994 averaged with a single Ninemile sediment collected during 1993 (Ecology, 1994).

Species characteristics

Fish species used for target PCB concentrations were rainbow trout and suckers. The model has output parameters built in for rainbow trout. The sucker species built into the model is white sucker (*Catostomus commersoni*). This species has similar habits and foraging characteristics as largescale and bridgelip suckers, and may even interbreed with largescale suckers where their ranges overlap (Wydoski and Whitney, 1979), and was therefore deemed a suitable substitute.

The model also allows for yellow perch, smallmouth bass, and largemouth bass as target endpoints (criteria). These species are found in Lake Spokane and the Spokane Arm, with limited populations of smallmouth bass in upstream reaches. However, these species were not selected to establish critical PCB concentrations because they generally have much lower PCB concentrations than lipid-rich species such as trout and sucker (e.g. Ecology, 1995; Jack and Roose, 2002). For these species, the target tissue concentration of 0.1 ng/g would be achieved with much higher water and sediment PCB levels.

Rainbow trout lipid content used in Table H-1 was the average of rainbow trout analyzed whole from four Spokane River locations. Weight was an approximation of present and historical Spokane River rainbow trout collected for analysis. For largescale suckers, lipid fraction in Table H-1 was an average of whole bodies from all available Spokane River samples, historic and present. Weight was the average of all suckers analyzed whole for the present study.

Diet of target fish species in Table H-1 was based on observations of gut contents. Diet composition of fish prey items (zooplankton and benthic species) was based on likelihood rather than site-specific observations.

Whole body to fillet conversion

The model produces a whole organism output for PCB concentrations in fish, which assumes that the chemical is distributed homogeneously among tissues of an organism. This limitation of the model may be an over-simplification when applied to complex organisms such as fish. To achieve the target concentration in fillet tissue, a conversion factor of 1.47 was applied based on the work of Amrhein et al. (1999). Limited data on paired whole fish-fillet data from the Spokane River (Johnson, 2000) yielded a conversion factor of 1.18 for rainbow trout and 2.73 for largescale suckers. This indicates that the water and sediment PCB concentrations used in the model along with the published conversion factor may be conservative for predicting target concentrations in suckers, while those used to predict rainbow trout targets may contain a slightly high bias.

Chemical characteristics

Total PCB was analyzed as the chemical of interest in the model to provide a simplified method of calculating PCB endpoints. The log K_{ow} and Henry's Law constant for total PCB used for the model were the same as those used to translate SPMD concentrations to water concentrations (Table H-1). For SPMDs, these parameters yield values similar to total PCBs calculated by summing individual congeners separately.

Validation and sensitivity

Prior to use, the model was validated using input parameters representative of the Spokane River and reach-specific fish weight and lipid data from recent sampling. Predicted and observed tissue concentrations were similar (Table H-2).

Table H-2. PCB Concentrations in Fish Tissue Predicted Using the Arnot-Gobas Food Web Bioaccumulation Model vs. Observed PCB Concentrations.

	Reach				
	Stateline-Upriver	Monroe-Ninemile	Lake Spokane	Little Falls	Spokane Arm
Measured PCB concentrations in water and sediment					
Dissolved total PCB conc. in water (pg/l)	83	222	332	na	na
total PCB conc. in sediment (ng/g dw)	54	78	33	1.9	10
Total PCB concentrations in whole rainbow trout (ng/g ww)					
Predicted	87	31**	55	--	--
Observed*	51	40**	na	na	na
Total PCB concentrations in whole suckers (ng/g ww)					
Predicted	110	26**	98	--	--
Observed*	99	29**	224	na	na

*PCB concentrations in fillet converted to whole fish by multiplying by 1.47.
**Ninemile only. Recent tissue data not available for Monroe St.
na: not available.

The model was not calibrated by adjusting the algorithms to match predicted and observed results. The decision to apply this model was made only after sampling had been completed. However, the necessary input parameters were easily obtained from current or historical data, and default values for physical, chemical, and species characteristics – originally used to model PCBs in the Lake Ontario food web – are applicable to the Spokane River.

A cursory assessment of model sensitivity was done by inserting ranges of values for the input parameters discussed in previous sections. The model is somewhat sensitive to changes in POC, sediment TOC, percent lipid in target fish, and prey composition for target fish. A 50% change in these model parameters results in an approximate 15% change in the target fish PCB concentrations when other model parameters are held at values typical for the Spokane River.

The model is particularly sensitive to log K_{ow} values, which can be expected due to the log K_{ow} as one of the most important factors driving the partitioning of PCBs between water and lipid soluble compartments. The response to changes in log K_{ow} is an approximate 10% decrease in target fish PCB concentrations with each 0.1 decrease in log K_{ow} around the value used for the Spokane River (log K_{ow} = 6.4). Increases of 0.1 in log K_{ow} result in approximately 10% increases in fish PCB concentrations. Of course, these responses are not linear, and the limited information provided here cannot be used to calculate target fish PCB concentrations, but they offer a glimpse at how the model output responds to certain input parameters.

Appendix I: Glossary Acronyms, Symbols, and Units

Ambient: Surrounding environmental condition (for example, surrounding air temperature).

Benthic: Bottom-dwelling organisms.

Best Management Practices (BMPs): Physical, structural, and/or operational practices that, when used singularly or in combination, prevent or reduce pollutant discharges.

Clean Water Act: Federal act passed in 1972 that contains provisions to restore and maintain the quality of the nation's waters. Section 303(d) of the Clean Water Act identifies water quality impaired waterbodies.

Composite sample: A representative sample created by the homogenization of multiple fish.

Congener: In chemistry, congeners are related chemicals. For example, polychlorinated biphenyls (PCBs) are a group of 209 related chemicals that are called congeners.

Designated uses: Those uses specified in Chapter 173-201A WAC (Water Quality Standards for Surface Waters of the State of Washington) for each waterbody or segment, regardless of whether or not the uses are currently attained.

Discharge: The rate of streamflow at a given instant in terms of volume per unit of time, typically cubic feet per second.

Effluent: An outflowing of water from a natural body of water or from a man-made structure. For example, the treated outflow from a sewage treatment system.

Exceeded criteria: Did not meet criteria.

Harmonic mean flow: One of several methods of calculating an average rate of flow. The harmonic mean is defined as $Q_h = n/\Sigma(1/Q_i)$ where n is the number of recorded flows Q_i. The harmonic mean is never larger than the geometric mean or the arithmetic mean.

Grab: A discrete sample from a single point in the water column or sediment surface.

Homologue: A chemical compound from a series of compounds that differs only in the number of repeated structural units.

Legacy pesticides: Banned pesticides no longer used but that persist in the environment.

National Pollutant Discharge Elimination System (NPDES): National program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements under the Clean Water Act. The NPDES program regulates discharges from wastewater treatment plants, large factories, and other facilities that use, process, and discharge water back into lakes, streams, rivers, bays, and oceans.

Parameters: Water quality constituent being measured (analyte). A physical, chemical, or biological property whose values determine environmental characteristics or behavior.

Point source: Sources of pollution that discharge at a specific location from pipes, outfalls, and conveyance channels to a surface water. Examples of point source discharges include municipal wastewater treatment plants, municipal stormwater systems, industrial waste treatment facilities, and construction sites that clear more than 5 acres of land.

Pollution: Such contamination, or other alteration of the physical, chemical, or biological properties, of any waters of the state. This includes change in temperature, taste, color, turbidity, or odor of the waters. It also includes discharge of any liquid, gaseous, solid, radioactive, or other substance into any waters of the state. This definition assumes that these changes will, or are likely to, create a nuisance or render such waters harmful, detrimental, or injurious to (1) public health, safety, or welfare, or (2) domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or (3) livestock, wild animals, birds, fish, or other aquatic life.

Reach: A specific portion or segment of a stream.

Sediment: Solid fragmented material (soil and organic matter) that is transported and deposited by water and covered with water (example, river or lake bottom).

Stormwater: The portion of precipitation that does not naturally percolate into the ground or

evaporate but instead runs off roads, pavement, and roofs during rainfall or snow melt. Stormwater can also come from hard or saturated grass surfaces such as lawns, pastures, playfields, and from gravel roads and parking lots.

Surface waters of the state: Lakes, rivers, ponds, streams, inland waters, salt waters, wetlands, and all other surface waters and water courses within the jurisdiction of Washington State.

Suspended particulate matter (SPM): Particulates suspended in the water column.

Total Maximum Daily Load (TMDL): A distribution of a substance in a waterbody designed to protect it from exceeding water quality standards. A TMDL is equal to the sum of all of the following: (1) individual wasteload allocations for point sources, (2) the load allocations for nonpoint sources, (3) the contribution of natural sources, and (4) a Margin of Safety to allow for uncertainty in the wasteload determination. A reserve for future growth is also generally provided.

Total suspended solids (TSS): The suspended particulate matter in a water sample as retained by a filter.

Watershed: A drainage area or basin in which all land and water areas drain or flow toward a central collector such as a stream, river, or lake at a lower elevation.

303(d) list: Section 303(d) of the federal Clean Water Act requires Washington State periodically to prepare a list of all surface waters in the state for which beneficial uses of the water – such as for drinking, recreation, aquatic habitat, and industrial use – are impaired by pollutants. These are water quality limited estuaries, lakes, and streams that fall short of state surface water quality standards, and are not expected to improve within the next two years.

Acronyms, Symbols, and Units of Measurement

303(d):	Section 303(d) of the federal Clean Water Act
BAF:	bioaccumulation factor
BCF:	bioconcentration factor
BSAF:	biota-sediment accumulation factor
BW:	body weight
CFR:	Code of Federal Regulations
CSO:	combined sewer overflow
DOC:	dissolved organic carbon
dw:	dry weight
Ecology:	Washington State Department of Ecology
EIM:	Environmental Information Management (Ecology database accessible through internet)
EPA:	U.S. Environmental Protection Agency
FS:	feasibility study
GC/ECD:	gas chromatography/electron capture detection
GC/MS:	gas chromatography/mass spectrometry
MTCA:	Model Toxics Control Act
N:	number of samples
NIST:	National Institute of Standards and Technology
NPDES:	National Pollutant Discharge Elimination System
NTR:	National Toxics Rule
PCB:	polychlorinated biphenyl
RF:	risk factor
RI:	remedial investigation
RM:	river mile
RPD:	relative percent difference
SPM:	suspended particulate matter
SPMD:	semi-permeable membrane device
SRM:	standard reference material
SV:	screening value
TMDL:	Total Maximum Daily Load
Total PCB:	the sum of PCB congeners or Aroclors (also t-PCB)
TOC:	total organic carbon
TSS:	total suspended solids
UWP:	Spokane River Urban Waters Program
USGS:	U.S. Geological Survey
WAC:	Washington Administrative Code
WC:	water consumption
WDFW:	Washington Department of Fish and Wildlife
WDOH:	Washington State Department of Health
WQS:	water quality standard(s)
WRIA:	Water Resource Inventory Area

WSTMP:	Washington State Toxics Monitoring Program
ww:	wet weight
WWTP:	waste water treatment plant

C_d :	concentration in the dissolved phase
C_s :	concentration in sediment or solids
C_t :	concentration in tissue
C_w:	concentration in whole water
f_{oc}:	fraction of organic carbon
f_s:	fraction of solid in water
K_{oc}:	sediment-water partition coefficient normalized for organic carbon
K_{ow}:	octanol-water partitioning coefficient
Q:	discharge
q1*:	cancer slope factor
Pb:	lead

g:	gallon
cm:	centimeter
kg/day:	kilograms per day
L/kg:	liters per kilogram
MGD:	million gallons per day
mg/day:	milligrams per day
mg/L:	milligrams per liter (parts per million)
ML:	megaliter (one million liters)
mm:	millimeter
ng/g:	nanograms per gram (parts per billion)
ng/L:	nanograms per liter (parts per trillion)
pg/g:	picograms per gram (parts per trillion)
pg/l:	picograms per liter (parts per quadrillion)
Pa m3/mol:	Pascals cubic meter/mole

Prepared in cooperation with
WASHINGTON STATE DEPARTMENT OF ECOLOGY

Ecological Indicators of Water Quality in the Spokane River, Idaho and Washington, 1998 and 1999

Background

Urban and mining activities have affected the Spokane River that flows out of Coeur d'Alene Lake from Idaho into Washington. This large river (more than 150 feet wide) flows through the city of Spokane to the 7 Mile bridge site and is impounded by three dams used to generate hydroelectric power. From Spokane, the river continues west and joins the Columbia River 63 miles downstream. Historical and current mining activities in the Coeur d'Alene River Basin in Idaho have contributed large quantities of metals to Coeur d'Alene Lake (Grosbois and others, 2001). The USGS has documented elevated concentrations of cadmium, lead, and zinc entering the river from Coeur d'Alene Lake (Woods, 2000). The WDOE has placed the Spokane River on its 303(d) impaired water list (Clean Water Act) for high concentrations of trace metals that violate Washington's water-quality criteria (Washington State Department of Ecology, accessed May 1, 2003, at **http://www.ecy.wa.gov/programs/wq/303d/1998/1998_by_wrias.html**. In addition, studies done by the WDOE (1995) and USGS (MacCoy, 2001) have identified elevated concentrations of PCBs in fish and sediments.

Overview

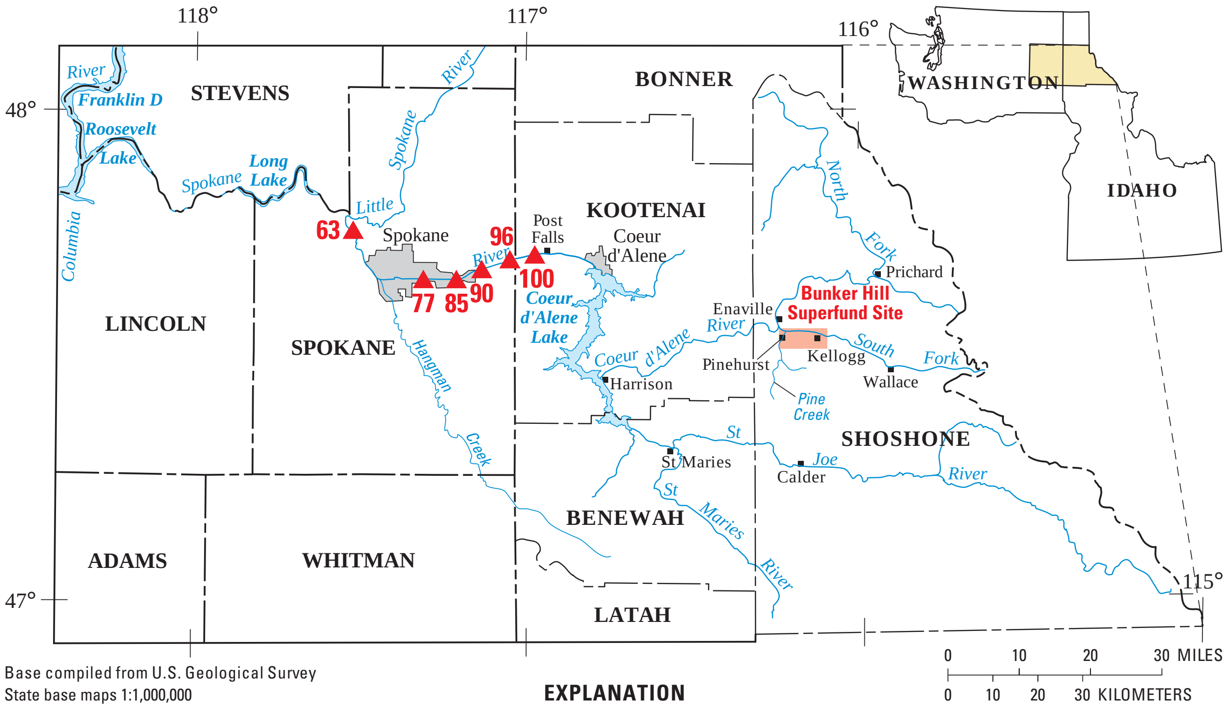
A water-quality investigation of the Spokane River was completed during summer low-flow conditions in 1998 and 1999 as part of the USGS NAWQA Program, in cooperation with the WDOE. (Abbreviations used in this report are defined on the last page.)

Samples for analyses of water chemistry; bed sediment; aquatic communities (fish, macroinvertebrates, and algae); contaminants in tissue (fish and macroinvertebrates); and associated measures of habitat were collected at six sites downstream from Coeur d'Alene Lake between river miles 63 and 100. These data provided baseline information to evaluate the water-quality status of the Spokane River and can be used to determine the ecological risk to aquatic organisms from contaminants.

The USGS, in cooperation with WDOE, sampled six sites along the Spokane River during the summers of 1998 and 1999 to evaluate urban and mining impacts on aquatic organisms (fig. 1). This study of the Spokane River was conducted as part of the NROK NAWQA Program to evaluate the status and trends in surface- and ground-water quality in parts of western Montana, northern Idaho, and eastern Washington (Tornes, 1997).

Ecological indicators were evaluated to determine the effects of multiple stressors on aquatic organisms. The ecological data collected at these sites are outlined in the sampling matrix table (table 1). The purpose of this study was to:

- Identify surface-water-quality and sediment-quality constituents of concern and determine whether those constituents were affecting aquatic organisms.
- Conduct a baseline aquatic community assessment at selected Spokane River sites.
- Compare aquatic community measures and metrics with those at least-impacted sites.
- Analyze contaminants in aquatic organisms and sediment and compare the results with established criteria.



EXPLANATION

▲ **Sampling site location; number, below, is mileage from mouth of river**

63 **Spokane River at 7 Mile bridge, Washington**
77 **Spokane River below Greene Street at Spokane, Washington**
85 **Spokane River at Sullivan Road bridge near Trentwood, Washington (Plantes Ferry)**
90 **Spokane River at Greenacres, Washington (near Barker bridge)**
96 **Spokane River above Liberty bridge at Harvard Road near Otis Orchards, Washington (State line)**
100 **Spokane River near Post Falls, Idaho**

Figure 1. Locations of sampling sites, Bunker Hill Superfund site, and the Spokane River Basin, Idaho and Washington.

Figure 2. Periphyton (algae attached to bottom substrate) were collected from riffle areas using protocols described by Porter and others (1993).

Periphyton

Samples of periphyton (algae attached to bottom substrate) were collected at all sites for analysis of CHLA (fig. 2). The concentration of CHLA in a sample indicates the level of nutrients in the river that are available to promote algal growth. Concentrations of CHLA between 100 and 150 milligrams per square meter (mg/m^2) have been suggested as an indicator of nuisance algal conditions (Welch and others, 1989; Watson and Gestring, 1996).

The Spokane River did not appear to be water-quality limited as a result of excessive algal growth at sites sampled during this study; however, the downstream CHLA concentration approached the nuisance level. At the upstream sites in the Spokane River, CHLA concentrations were between 2 and 10 mg/m^2, far below levels of nuisance algal growth. At the downstream site at the 7 Mile bridge, below sewage-treatment facilities and other industrial inputs, the CHLA concentration was 94 mg/m^2, which is approaching the nuisance level.

Table 1. Sampling matrix of ecological data collected by the USGS during 1998 and 1999 from selected sites on the Spokane River, Idaho and Washington, for a cooperative study with WDOE and for the NROK NAWQA Program.

[Locations of sampling sites shown in figure 1; O, samples collected in 1998; X, samples collected in 1999; X, data analyzed by WDOE[1]. Data analyzed by USGS for this study can be accessed at **http://idaho.usgs.gov/projects/spokane/index.html**]

	Site name					
	Post Falls	Otis Orchards (State line)	Greenacres	Sullivan Road bridge	Greene Street	7 Mile bridge
River mile	100	96	90	85	77	63
USGS site ID	12419000	12419500	12420500	12420800	12422000	12424500
Latitude Longitude	47°42'11" 116°58'37"	47°40'56" 117°05'05"	47°40'45" 117°09'25"	47°40'40" 117°11'43"	47°40'40" 117°22'20"	47°44'25" 117°31'10"
Periphyton (chlorophyll- *a* and biomass)	X	X	X	X	X	X
Macroinvertebrate community	OX	X	X	X	X	X
Fish community	OX	X		X	X	OX
Habitat assessment	X					X
Continuous (hourly) summer water temperature	OX	X			X	X
Trace metals–macroinvertebrates	X	X	X	X	X	X
Trace metals–fish tissue	X	X		X		OX
Organochlorines–fish tissue	X	X		X		O
Trace metals–sediment	OX					OX
Organochlorines–sediment	OX					OX
Trace metals and PCBs–whole rainbow trout, largescale suckers, and mountain whitefish[1]		X		X	X	X

[1]See the WDOE home page (**http://www.ecy.wa.gov/**) for further details about their sampling effort on the Spokane River.

Figure 3. Macroinvertebrates were sampled at all sites in the Spokane River using protocols described by Cuffney and others (1993).

Macroinvertebrate Community

Macroinvertebrates were collected from riffle habitats for community assessment and analysis of metal concentrations in caddisflies (fig. 3). Even though the total abundance of macroinvertebrates collected in 1999 at the Spokane River sites was higher than at least-impacted sites (sites upstream from urban and mining impacts sampled as part of the NROK NAWQA) on the North Fork Coeur d'Alene River at Enaville and the St. Joe River near Calder (Maret and others, 2001), the number of individual taxa (indicating biological diversity) was much lower. In fact, the number of mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Trichoptera), referred to as EPT taxa, was 2 to 3 times lower at Spokane River sites than at least-impacted sites (fig. 4). Stoneflies that are found at most least-impacted sites in

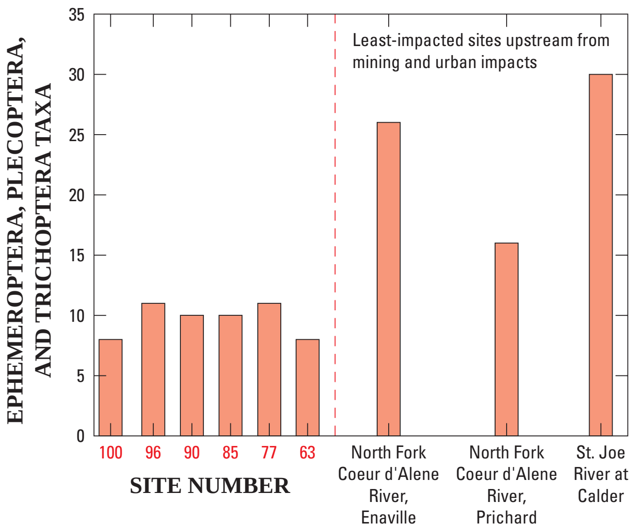


Figure 4. Ephemeroptera, Plecoptera, and Trichoptera taxa collected in the Spokane River, Idaho and Washington, compared with taxa collected at least-impacted sites, Idaho. (Site numbers shown in figure 1; data for least-impacted sites are given in report by Maret and others, 2001)

Idaho were absent from the Spokane River. On the basis of regional collections by Maret and others (2001), the Spokane River should be able to support at least five taxa of stoneflies. Even though measures of substrate (bottom material such as gravel or cobbles) size and percent embeddedness (amount of fine substrate surrounding larger substrate) did not indicate habitat degradation and were very low (less than 10 percent) for riffle habitats at all sampling sites, the low numbers of EPT taxa in the Spokane River indicated impaired water quality.

Fish Community

Fish were collected at each site as indicated in table 1. The fish were weighed, measured, and examined for anomalies (such as deformities, eroded fins, lesions, and tumors) using protocols described by Meador and others (1993). The fish species collected from the Spokane River are listed in table 2.

Salmonids will experience adverse health effects when exposed to temperatures outside their optimal range (U.S. Environmental Protection Agency, 2002) because they are coldblooded and their survival depends on external water temperatures. The Spokane River historically supported a strong native salmonid population (Youngs, 1996). The State of Washington has classified the Spokane River as “excellent” between river miles 58 and 96 (below the 7 Mile bridge site to the Idaho/Washington State line), meaning that water quality in this reach must meet or exceed goals for all uses, including salmon migration, rearing, spawning, and harvesting. In an effort to meet these goals, a temperature criterion of 20 degrees Celsius has been set for protection of coldwater species in this reach of the river (Washington State Department of Ecology, 1997). Idaho’s criterion for the protection of coldwater aquatic organisms is 22 degrees Celsius (Idaho Department of Environmental Quality, accessed January 28, 2003, at **http://www2.state.id.us/adm/adminrules/rules/idapa58/58index.htm**).

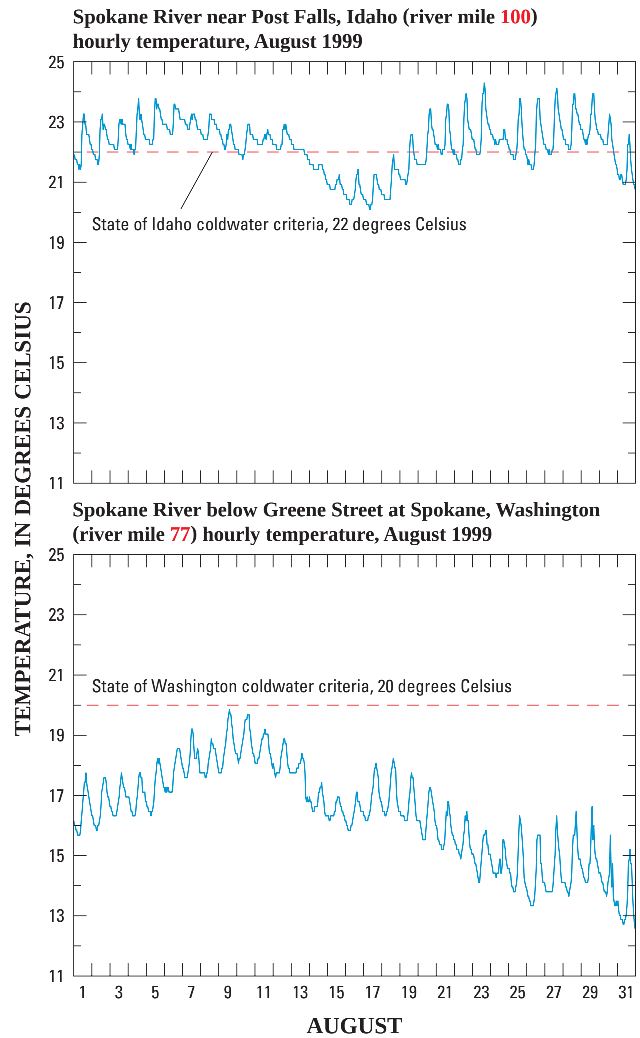


Figure 5. Hourly temperature measurements at Spokane River near Post Falls, Idaho, and Spokane River below Greene Street at Spokane, Washington, August 1999.

The upstream part of the Spokane River receives water from the surface of Coeur d’Alene Lake that is warmer than the river water. Coeur d’Alene Lake is a natural lake and outflow is controlled by Post Falls Dam. During the summer months, water temperature in the

Table 2. Number of fish species collected at selected reaches on the Spokane River, Idaho and Washington, 1998 and 1999

[Samples collected in 1998 unless otherwise indicated]

Family	Site name						
	Post Falls	Post Falls (1999)	Otis Orchards (State line)	Sullivan Road bridge	Greene Street	7 Mile bridge	7 Mile bridge (1999)
Salmonidae (trout and whitefish)			1	4	2	2	2
Cottidae (sculpins)		1	1			1	
Catostomidae (suckers)	1	1	1	2	1	2	2
Cyprinidae (minnows and carp)	3	3	3	3	2	4	2
Centrarchidae (sunfish)	4	1			1		
Ictaluridae (catfish and bullheads)	2	1					
Percidae (perch)	1						

river downstream from Post Falls Dam exceeds Idaho's and Washington's coldwater criteria (fig. 5). The fishery at this site consists mostly of warmwater species such as sunfish, minnows, and bullheads. During the summer, the Spokane River loses water to the SVRP aquifer in the upper parts of the study reach and receives cooler water from the SVRP aquifer in the downstream reach (Box and Wallis, 2002). Near river mile 85 at Sullivan Road bridge, cool SVRP aquifer water with temperatures between 8 and 10 degrees Celsius (Rod Caldwell, U.S. Geological Survey, written commun., 2002) flows into the river, providing habitat for coldwater salmonids such as chinook salmon, cutthroat, brown, and rainbow trout (table 2).

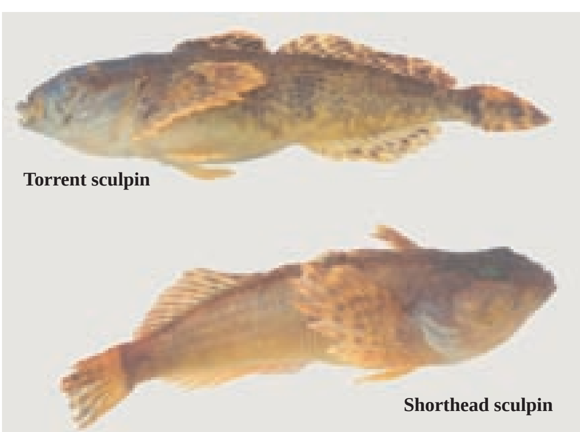


Figure 6. Sculpin (a bottom-feeding native fish), which are especially sensitive to metals (Maret and MacCoy, 2002), were found at only a few sites and in low numbers in the Spokane River.

Fish abundance was analyzed for individuals and species, and a population summary was calculated using 10 fish metrics (Mebane and others, 2003) that are useful for evaluating river conditions in the Pacific Northwest. The metrics are number of coldwater native species, number of cottid (sculpin) age classes (fig. 6), percent sensitive native individuals, percent coldwater individuals, percent tolerant individuals, number of alien species, percent common carp individuals, number of salmonid age classes, catch per unit effort (fish per minute of electrofishing), and percent selected anomalies. Each metric is given a value and all are summed to provide an IBI score ranging from 0 to 100 for each site. According to Mebane and others (2003), sites with IBI scores between 75 and 100 exhibit high biotic integrity with minimal disturbance and possess an abundant and diverse assemblage of native coldwater species. Sites with scores between 50 and 74 exhibit somewhat lower quality where alien species occur more frequently and the assemblage is dominated by coolwater, native spe-

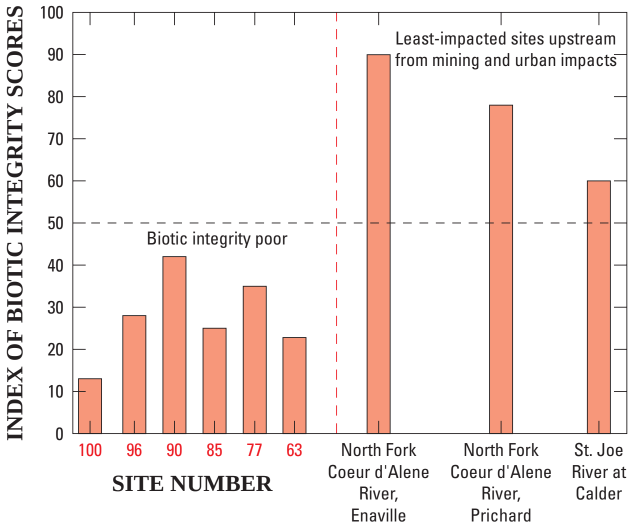


Figure 7. IBI scores for sites where fish were collected, Spokane River, Idaho and Washington, and for least-impacted sites, Idaho. (Site numbers shown in figure 1; data for least-impacted sites are given in report by Maret and others, 2001; scores based on 10 fish metrics given in report by Mebane and others, 2003)

cies. Sites with scores less than 50 indicate poor biotic integrity where coldwater and sensitive species are rare or absent, and where tolerant fish predominate. Sites with scores below 50 generally do not support a coldwater fishery. The Spokane River fish index scores indicate poor biotic integrity at all sites and sculpins were rare or absent. Index scores for the Spokane River, as well as those for least-impacted sites, are shown in figure 7.

Contaminants

Metals and organic contaminants have been measured at varying concentrations in water, sediment, and tissue of fish in the Spokane River. Elevated zinc has been measured in surface water between Post Falls and 7 Mile bridge at concentrations above the acute water-quality criteria of 35 micrograms per liter in water with a hardness value of 25 milligrams per liter (U.S. Environmental Protection Agency, 1987; Clark, 2003). Low concentrations of pesticides and VOCs also have been measured in surface water at the 7 Mile bridge site (Craig Bowers, U.S. Geological Survey, written commun., 2002).

Historical mining in the Coeur d'Alene River Basin has caused increased metal concentrations downstream in the Spokane River water, sediment, and fish tissue (Kadlec, 2000; Grosbois and others, 2001; Box and Wallis, 2002). Metals such as lead and zinc in streambed sediment can be harmful to aquatic organisms (Maret and others, in press). The PEL at which lead exposure would cause frequent adverse effects to aquatic organisms is 91.3 milligrams per kilogram, or ppm dry weight (Washington State Department of Ecology, 2002). The concentration of lead measured in 1998 in sediment smaller than 63 microns at Post Falls was 1,620 ppm dry weight, which exceeded the PEL. A lead concentration of 47.3 ppm measured in sediment at the 7 Mile bridge site that same year was below the PEL but still considered elevated. In 1998, the concentration of zinc in sediment at Post Falls (3,210 ppm) and 7 Mile bridge (319 ppm) exceeded the PEL of 315 ppm (Washington State Department of Ecology, 2002).

Concentrations of lead and zinc in tissue of caddisflies (the main diet of many fish species) from the Spokane River were 5 times the average concentrations in tissue of caddisflies from least-impacted sites. The concentrations in caddisflies collected in the Spokane River in 1999 were 3 micrograms per gram for lead and 180 micrograms per gram for zinc (Maret and others, in press) (figs. 8 and 9).

Elevated concentrations of metals from mining and PCBs from industrial and urban sources have been measured in tissue of fish from the Spokane River over the past 10 years (Johnson and others, 1994; Johnson, 1999; Johnson, 2000; Kadlec, 2000; MacCoy, 2001; Maret and MacCoy, 2002). Metal concentrations in whole fish were elevated compared with concentrations in fish measured during national surveys (Johnson and others, 1994).

Figure 8. Collection trays for caddisfly (*Hydropsyche* sp.) tissue analyzed for metals.

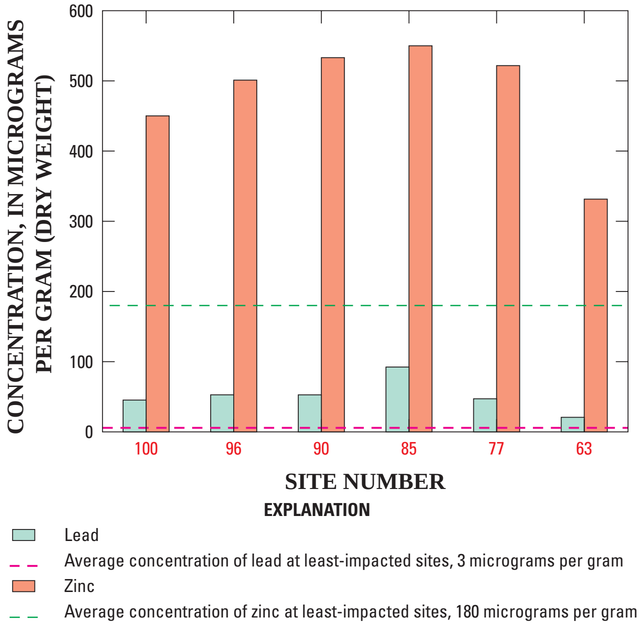


Figure 9. Concentrations of lead and zinc measured in tissue of caddisflies collected from sites on the Spokane River, Idaho and Washington, 1999, compared with average concentrations in tissue of caddisflies collected from least-impacted sites, Idaho. (Site numbers shown in figure 1; data for least-impacted sites are given in report by Maret and others, 2001)

Concentrations of lead and PCBs in fish tissue pose a threat to the public who eat fish caught between the Idaho/Washington State line and 7 Mile bridge site. PCBs in sportfish ranged from 70 to 1,610 micrograms per kilogram, or ppb (MacCoy, 2001), during this study and exceeded the human consumption criterion of 5 ppb for edible fish tissue (U.S. Environmental Protection Agency, 1999). In response to these high concentrations of lead and PCBs in fish tissue, a fish advisory for sections of the Spokane River was issued by the Washington State Departments of Ecology and Health (1999).

PCB concentrations in tissue of whole fish from the Spokane River near Post Falls (270 ppb) and Otis Orchards (500 ppb) ranked in the top 25 percent of concentrations in the 205 fish collected from streams in mixed land-use areas across the Nation but ranked far below the highest concentrations (in excess of 10,000 ppb) in tissue of fish from rivers in the Northeast (Lisa Nowell, U.S. Geological Survey, written commun., 2002, NAWQA data from 1991 and 1994 study units).

Conclusions

- Aquatic organisms in the Spokane River are affected by multiple stressors (metals, PCBs, and temperature).
- Exposure risk of aquatic organisms to elevated temperature and contaminants, such as metals and PCBs, depends on where impairment occurs in the river and the type of organism exposed.
- Major groups of native aquatic fauna, such as stoneflies and sculpins, are rare or absent in the Spokane River.
- The brevity of sampling for this study did not allow adequate determination of the extent or permanence of contamination or impairment, nor did it allow for determination of the most important stressors. Further studies targeting specific ecological indicators of various pollutants are needed to identify those stressors that are most limiting to aquatic organisms.

—Dorene E. MacCoy and Terry R. Maret

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ABBREVIATIONS USED IN THIS REPORT:

CHLA	chlorophyll-*a*
IBI	Index of Biotic Integrity
NAWQA	National Water-Quality Assessment
NROK	Northern Rockies Intermontane Basins
PCBs	polychlorinated biphenyls
PEL	Probable Effect Level
ppb	parts per billion
ppm	parts per million
SVRP	Spokane Valley-Rathdrum Prairie
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
VOCs	volatile organic compounds
WDOE	Washington State Department of Ecology

THE DEPARTMENT OF ECOLOGY
Environmental Assessment Program

November 17, 2011

TO: Ted Hamlin, Water Quality Program, ERO
Dave Moore, Water Quality Program, ERO
Arianne Fernandez, Hazardous Waste & Toxics Reduction Program, ERO
Dave George, Toxics Cleanup Program, ERO

THROUGH: Will Kendra, Environmental Assessment Program, Statewide Coordination Section Manager WK
Dale Norton, EAP, Toxics Studies Unit Supervisor

FROM: Patti Sandvik, EAP Toxics Studies Unit, Project Manager PS

SUBJECT: **Baseline Summary of a Long-term Monitoring Effort in the Spokane River for PCBs, PBDEs, and Metals**

Background

The Spokane River in eastern Washington contains elevated levels of polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs), dioxins/furans, and metals. These contaminants are prevalent in water, sediment, and fish tissue. There are numerous studies and clean-up activities addressing contamination in the Spokane River. Information about the Spokane River, water quality, research studies, clean-up efforts, and resources can be found on Washington State Department of Ecology's (Ecology) website for the Spokane River Basin at www.ecy.wa.gov/geographic/spokane/spokane_river_basin.htm.

The Spokane River has been part of several statewide monitoring efforts for some years. These statewide efforts increased sampling in the Spokane River in 2009 and 2010 in order to help develop a long-term effectiveness monitoring program (Era-Miller, 2009) for the Spokane River Urban Waters Initiative (www.ecy.wa.gov/urbanwaters/spokaneriver.html). This initiative focuses on urban waterbodies and aims to prevent contamination or re-contamination of waterways by identifying and eliminating toxic chemicals at their source.

The goal of the 2009 and 2010 supplemental monitoring was to help establish a baseline characterization of PCBs, PBDEs, arsenic, cadmium, lead, and zinc as part of the beginning efforts of the Urban Water Initiative. The supplemental monitoring was conducted as part of three long-term statewide efforts, with extra sites and analytes added for the Spokane River sites:

- The River and Stream Water Quality Monitoring program samples for metals and conventional parameters (Hallock and Ehinger, 2003; Hallock, 2007; Hopkins, 1995).

- Monitoring for PBTs using Suspended Particulate Material (SPM). Lead is the main target analyte; arsenic, cadmium, and zinc were added for the Spokane River sites (Meredith and Furl, 2008).

- Monitoring for Persistent, Bioaccumulative and Toxic (PBT) chemicals using semi-permeable membrane devices (SPMDs). Target chemicals included pesticides, PCBs, PBDEs, and PAHs (Johnson, 2007a; Sandvik, 2010a).

A description of the long-term monitoring programs, access to historical data and previous annual reports can be found on Ecology's Internet web site at www.ecy.wa.gov under the "Environmental Assessment" program. Water quality monitoring information is listed under "River and Stream Water Quality Monitoring" at www.ecy.wa.gov/programs/eap/fw_riv/rv_main.html and the PBT Trends can be found listed under "Toxics Monitoring by Ecology" in the "Washington State Toxics Monitoring Program" (WSTMP) at www.ecy.wa.gov/programs/eap/toxics/wstmp.htm.

Methods and results are summarized below.

Monitoring Design

Sites and Timeframes

Two locations were sampled for the baseline characterization effort (Figure 1). These sites are currently being used in the PBT studies and in the River and Stream Water Quality Monitoring program although additional sampling and analytes were added for the baseline project. Descriptions of the monitoring sites are in Appendix A.

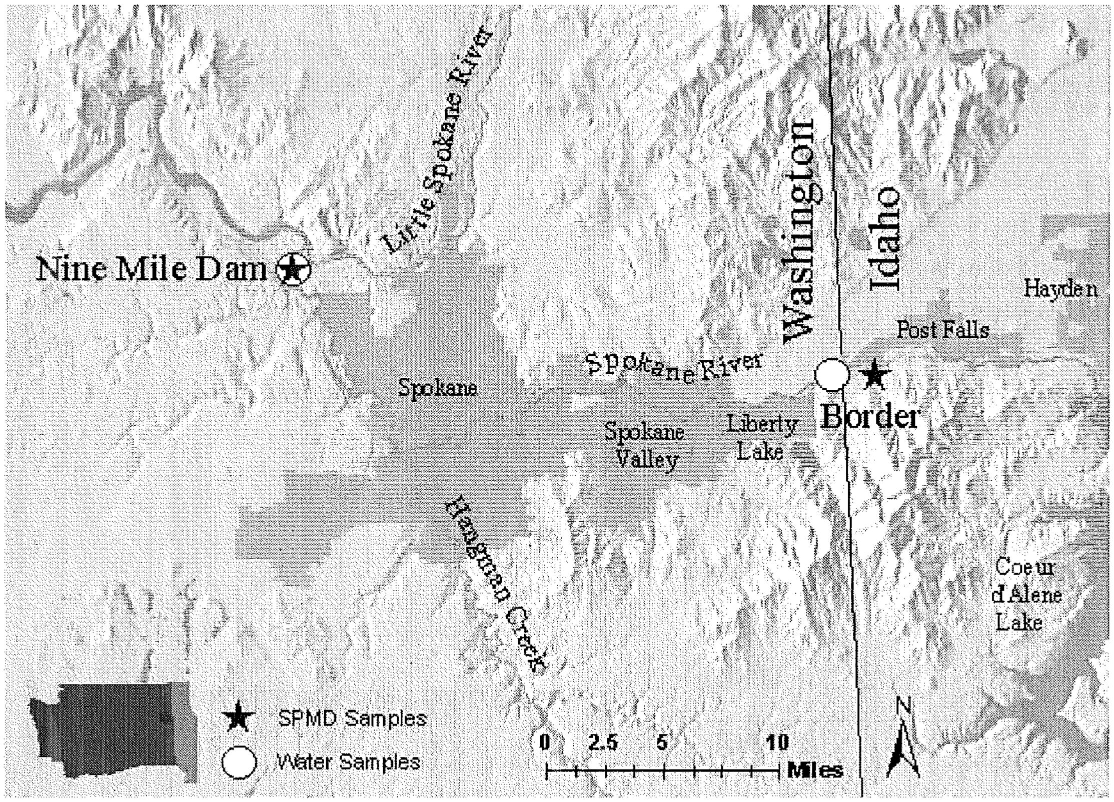


Figure 1. Site Locations in the Spokane River.

Sampling took place in fall 2009 (September) and spring 2010 (May and June). Sampling during these periods captured typical seasonal low-flow (fall) and high-flow (spring) conditions for the river. Sample collection by the various methods usually overlapped in time. SPM collection was taken twice during each of the SPMD deployments. Water samples were taken during one SPMD deployment, and after one SPMD deployment.

Methods

Chemicals Monitored

Table 1 shows analytes monitored by collection method for each sampling period.

Table 1. Chemical, Metal, and Ancillary Parameters Analyzed.

<table>
<tr><th>Parameters</th><th>Collection Method</th><th colspan="3">Sampling Timeframe</th></tr>
<tr><td colspan="5">Water</td></tr>
<tr><td>Lead, total and dissolved</td><td rowspan="8">Grab</td><td colspan="3" rowspan="11">9/22/2009 and 6/14/2010</td></tr>
<tr><td>Arsenic, total and dissolved</td></tr>
<tr><td>Cadmium, total and dissolved</td></tr>
<tr><td>Zinc, total and dissolved</td></tr>
<tr><td>Hardness</td></tr>
<tr><td>TOC</td></tr>
<tr><td>TSS</td></tr>
<tr><td>Flow</td></tr>
<tr><td>Conductivity</td><td rowspan="3">Field measurement</td></tr>
<tr><td>Water temperature</td></tr>
<tr><td>pH</td></tr>
<tr><td>PBDEs</td><td rowspan="2">SPMDs[1]</td><td colspan="3" rowspan="3">9/3-30/2009 and 4/28 - 5/27/2010</td></tr>
<tr><td>PCB congeners</td></tr>
<tr><td>Water temperature</td><td>TidbiTs[1,2]</td></tr>
<tr><td>TOC</td><td rowspan="2">Grab</td><td rowspan="4">9/3/2009 and 4/28/2010</td><td rowspan="4">9/21/2009 and 5/14/2010</td><td rowspan="4">9/30/2009 and 5/27/2010</td></tr>
<tr><td>TSS</td></tr>
<tr><td>Water temperature</td><td rowspan="2">Field measurement</td></tr>
<tr><td>Conductivity</td></tr>
<tr><td colspan="5">Particulates</td></tr>
<tr><td>Lead, particulates</td><td rowspan="5">SPM</td><td rowspan="6">9/3/2009 and 4/28/2010</td><td rowspan="6">-</td><td rowspan="6">9/30/2009 and 5/27/2010</td></tr>
<tr><td>Arsenic, particulates</td></tr>
<tr><td>Cadmium, particulates</td></tr>
<tr><td>Zinc, particulates</td></tr>
<tr><td>TSS, particulate fraction</td></tr>
<tr><td>pH</td><td>Field measurement</td></tr>
</table>

1. Passive monitoring: continuous or near continuous sample collection.
2. TidbiTs: Onset Computer Corporation Hoboware temperature loggers.

SPM: suspended particulate matter.
SPMD: semipermeable membrane devices.
TOC: total organic carbon.
TSS: total suspended solids.

Whole water samples for metals were collected once during each sampling period. SPM and SPMD samples were collected near each other and during the same sampling time period.

Conventional parameters such as TOC, TSS, water temperature, pH, and conductivity were collected during all sampling efforts (i.e. metals, SPM, and SPMDs), which may have varying sampling timeframes.

Field Procedures

Sample collection and field measurements followed Ecology's standard operating procedures (SOPs). SOPs followed for this study are listed in Appendix B.

Brief descriptions of field procedures referenced to each project's Quality Assurance Project Plans (QAPPs) are:

- Water sample collections were single, near-surface grab samples from highway bridges (Hallock and Ehinger, 2003; Hallock, 2007; and Hopkins, 1995).

- SPM were collected using in-line filtration of river water taken from 0.5 - 3 feet below the surface (Meredith and Furl, 2008).

- Sample collection with SPMDs used a composite of 5 standard SPMD membranes and then deployed into the water for a one-month period. The SPMDs were deployed for approximately 28 days each sampling period (Johnson 2007a; Sandvik, 2010a).

Laboratory Procedures

Chemicals analyzed in the samples collected at each site are shown in Table 1 above.

Water and SPM samples were analyzed by Ecology's Manchester Environmental Laboratory (MEL). The SPMDs were prepared and processed by their manufacturer, Environmental Sampling Technology Laboratory (EST). The SPMD extracts were then analyzed by other laboratories: MEL performed PBDEs analyses while Analytical Perspectives Laboratory conducted PCB congener analyses.

Analytical methods, reporting limits, and a brief discussion on how final results are reported in this document can be found in Appendix C.

Detailed information regarding extraction, clean-up, analysis, and data reduction can be found in the QAPPs (referenced above). Annual reports with the Spokane River results discussed here include:

- River and Stream Water Quality Monitoring Report Water Year 2009 (Hallock, 2010b).

- River and Stream Water Quality Monitoring Report Water Year 2010 (Hallock, 2011).

- PBT Trend Monitoring: Measuring Lead in Suspended Particulate Matter from Washington State Rivers and Lakes, 2009 Results (Meredith and Furl, 2010).

- PBT Trend Monitoring: Measuring Lead in Suspended Particulate Matter from Washington State Rivers and Lakes, 2010 Results (Meredith and Roberts, 2011).

- Washington State Toxics Monitoring Program: Monitoring with SPMDs for PBTs in Washington Waters in 2009 (Sandvik and Seiders, 2011).

- Washington State Toxics Monitoring Program: Monitoring with SPMDs for PBTs in Washington Waters in 2010 (in draft).

Data Quality

The QAPP developed for each study established data quality requirements for accuracy, bias, and reporting limits with measurement quality objectives (MQOs). The project lead for each study compared results from field and laboratory QC samples to the MQOs to determine if the MQOs were met. Based on these assessments and reviews of laboratory data verification reports, the data were accepted, accepted with appropriate qualifications, or rejected. Results presented here were accepted and any qualifiers were retained. A summary of field and laboratory data quality are presented in Appendix D. For more discussion of specific data quality, refer to each project's annual report.

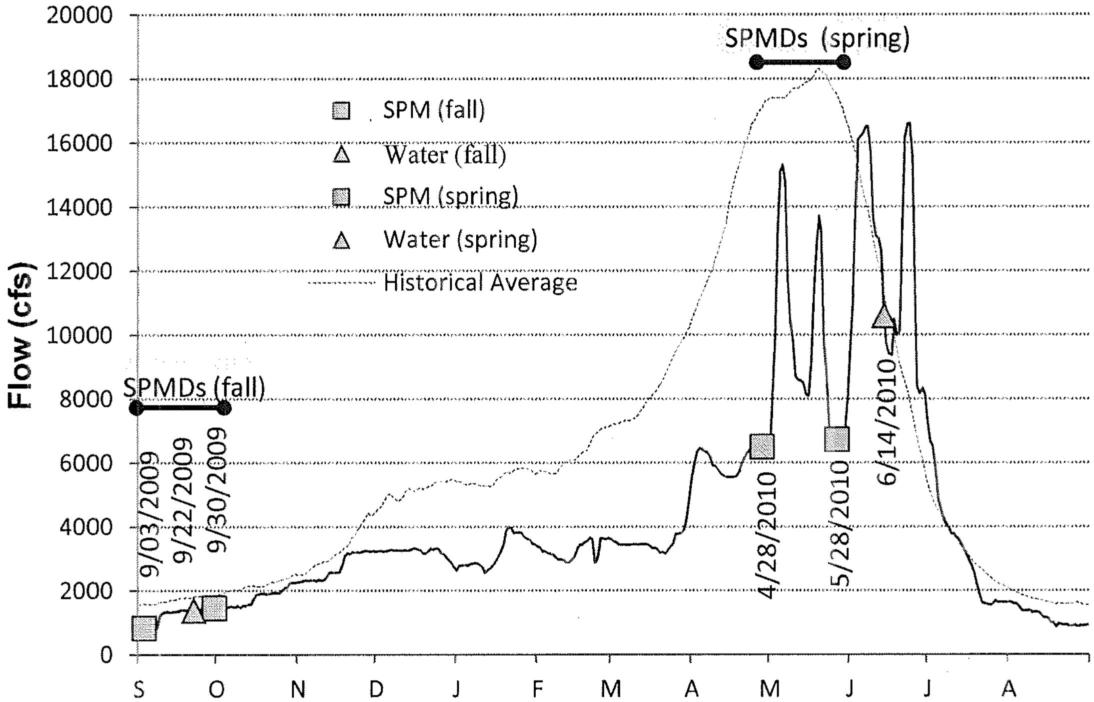
Results and Discussion

Data for this study is available at Ecology's Environmental Information Management (EIM) website www.ecy.wa.gov/eim/index.htm or by contacting Ecology. At the website, search EIM User Study ID, AMS001 (water results) or PbTrends09 and PbTrends10 (SPM results). Data for SPMDs are not stored in Ecology's EIM system. SPMD data can be obtained by contacting the Ecology project officer: Patti Sandvik at patti.sandvik@ecy.wa.gov.

Discussions of the chemistry results follow a description of the flow in the Spokane River during the sampling events.

Flow

The Spokane River flow was below historical average for both sampling periods (2009 fall and 2010 spring) (Hopkins, 2009; Hopkins, 2010) during SPMD, SPM, and metal (2009 fall only) collection. Flow was above historical average for the metals sampling event in spring of 2010 (Hopkins, 2010). Figure 2 shows sample collections in relation to flow.



Flows taken from USGS real-time water data station 12422500 Spokane River at Spokane (http://waterdata.usgs.gov/wa/nwis/rt).

Figure 2. Stream Flow Pattern and Sampling Events in 2009 (fall) and 2010 (spring).

In the summer of 2009, low precipitation events coupled with above normal temperatures during July and August kept the majority of statewide in-stream flow levels (including Spokane River) towards the lower end of their normal historical ranges. Although precipitation and temperatures returned to normal in September, river levels remained below normal during the sampling period for this project.

In May of 2010, a majority of Washington State rivers had above normal flows, but not the Spokane River. Below normal precipitation was experienced most of the winter months (December through March) resulting in below normal river levels in most rivers statewide. Increased precipitation near the end of April increased river levels.

When SPMD and SPM sampling began at the end of April 2010, the Spokane River was below its 20th percentile: only 20 percent of historical stream flow for this time period fell below this level. The flow increased to between the 20th and 50th percentile (median historical stream flow) by the end of May when sampling ended. Above normal precipitation in June increased flow in the Spokane River (as well as the majority of rivers statewide) to above historical levels. Metals were sampled in the middle of June and, therefore, they sampled at or above historical river levels.

Chemistry Results

Chemistry results are shown in Table 2 (fall 2009) and Table 3 (spring 2010). Results reported in bold are above the Washington State Water Quality chronic criteria for dissolved metals or the Lowest Apparent Effects Threshold (LAET) for particulates. Results are discussed further for each sampling type (water, SPM, and SPMDs) below.

Table 2. Results of Chemical and Metal Tests of Spokane River Collected Fall 2009.

2009 Fall	Spokane R. at Nine Mile Dam				Spokane R. near Idaho Border			
Metals	***SPM*** 9/3/2009	***Water*** 9/22/2009		***SPM*** 9/30/2009	***SPM*** 9/3/2009	***Water*** 9/22/2009		***SPM*** 9/30/2009
Parameter	particulates (mg/Kg)	dissolved (ug/L)	total (ug/L)	particulates (mg/Kg)	particulates (mg/Kg)	dissolved (ug/L)	total (ug/L)	particulates (mg/Kg)
Lead	135	0.083	0.37	143	**653**	0.142	1.49	**809**
Arsenic	20.7	2.98	2.79	17.2 U	29.4 U	0.48	0.46	50.0 U
Cadmium	16.7 U	0.053	0.10 U	17.2 U	29.4 U	0.065	0.12	50.0 U
Zinc	**1090**	8.9	12.4	**2800**	**3547**	22.9	27.8	**4420**
Organics	***SPMD*** 9/3-30/2009				***SPMD*** 9/3-30/2009			
Parameter	dissolved (pg/L)				dissolved (pg/L)			
Total PCBs	83				46			
Total PBDEs	240				33			
Conventionals	***SPM, SPMD*** 9/3/2009	***SPMD*** 9/21/2009	***Water*** 9/22/2009	***SPM, SPMD*** 9/30/2009	***SPM, SPMD*** 9/3/2009	***SPMD*** 9/21/2009	***Water*** 9/22/2009	***SPM, SPMD*** 9/30/2009
Flow (cfs)	-	-	1195	1300[a]	-	-	742	1037[a]
Water Temperature (C°)	16.8	-	13.3	13.1, 14.8[b]	22		19.2	17.5, 19.5[b]
Conductivity (us/cm)	276	218	290	215	51, 49	50	52	46, 48
pH	8.4	-	8.38	8.2	7.8		7.6	8.1
TSS (mg/L)	1, 2	2	2	2, 2	1, 1 U	1 U	2	1, 1 U
TOC (mg/L)	1.0 U	1.2	1.1	1.3	1.5	1.3	1.4	1.7
Hardness (mg/Kg)	-	-	131	-	-	-	20.6	-

SPM: suspended particulate matter.
SPMD: semipermeable membrane device.
Water: Water grab samples.
TSS: total suspended solids.
TOC: total organic carbon.

U = not detected above reporting limit.
a. geometric mean for sampling period 9/3-30/2009.
b. average temperature for sampling period 9/3-30/2009.
- No individual result. May be part of an average or not analyzed.

Table 3. Results of Chemical and Metal Tests of Spokane River Collected Spring 2010.

2010 Spring	**Spokane R. at Nine Mile Dam**				**Spokane R. near Idaho Border**			
Metals	***SPM*** 4/28/2010	***Water*** 6/14/2010		***SPM*** 5/27/2010	***SPM*** 4/29/2010	***Water*** 6/14/2010		***SPM*** 5/27/2010
Parameter	particulates (mg/Kg)	dissolved (ug/L)	total (ug/L)	particulates (mg/Kg)	particulates (mg/Kg)	dissolved (ug/L)	total (ug/L)	particulates (mg/Kg)
Lead	**338**	0.142	1.40	212	**1091**	0.145	1.28	**471**
Arsenic	23.7	0.68	0.66	22.7 U	62.5 U	0.35	0.33	41.7 U
Cadmium	20.8 U	0.158	0.20	22.7 U	62.5 U	0.183	0.22	41.7 U
Zinc	**2333**	40.6	45.0	**1391**	**4088**	**46.8**	51.0	**2942**
Organics	***SPMD*** 4/27 - 5/27/2010				***SPMD*** 4/27 - 5/27/2010			
Parameter	dissolved (pg/L)				dissolved (pg/L)			
Total PCBs	85 JK				140 JK			
Total PBDEs	30 JK				41 JK			
Conventionals	***SPM, SPMD*** 4/28/2010	***SPMD*** 5/14/2010	***Water*** 6/14/2010	***SPM, SPMD*** 5/27/2010	***SPM, SPMD*** 4/29/2010	***SPMD*** 5/14/2010	***Water*** 6/14/2010	***SPM, SPMD*** 5/27/2010
Flow (cfs)	-	-	10873	9696[a]	-	-	10300	9722[a]
Water Temperature (C°)	8.8	-	15	12.6, 10.9[b]	7.8	-	14.8	12.4, 10.4[b]
Conductivity (us/cm)	92	84	84	109	50, 50	51	52	50, 48
pH	7.5	-	7.88	7.7	7.4	-	7.71	7.4
TSS (mg/L)	3, 3	4	3	4, 2	1, 2	1	2	2, 1
TOC (mg/L)	1.5	1.6	1.5	1.6	1.6	1.6	1.5	1.9
Hardness (mg/Kg)	-	-	35.2	-	-	-	20.8	-

SPM: suspended particulate matter.
SPMD: semipermeable membrane device.
Water: Water grab samples.
TSS: total suspended solids.
TOC: total organic carbon.

U = not detected above reporting limit.
JK: the analyte was positively identified. Reported results are an estimate with unknown bias.
a. Geometric mean for sampling period 4/27 - 5/27/2010.
b. Average temperature for sampling period 4/27 - 5/27/2010.
- No individual result. May be part of an average or not analyzed.

Water

Results from fall 2009 and spring 2010 whole water samples ranged from 0.083 – 0.145 ug/L for lead (dissolved) and 8.9 - 46.8 ug/L for zinc (dissolved) at the Nine Mile Dam and Stateline sites. The Stateline dissolved zinc result (46.8 ug/L) exceeded the Washington State Water Quality chronic criteria for dissolved metals (27.63 ug/L based on hardness) by 69% in 2010. Furthermore, dissolved zinc at the Stateline site exceeded the criterion in all months for water year 2009 except August and September (Hallock, 2010b).

Dissolved cadmium was also higher in the Spokane River than typical for these two sampling periods (ranged 0.053 – 0.183 ug/L), but below the criteria for dissolved concentration based on hardness (ranged 0.32 – 1.36 ug/L). Many dissolved arsenic results were also elevated above the statewide median 0.55 ug/L, ranging from 0.35 to 2.98 ug/L, but lower than other sites statewide and considerably lower than the chronic water quality criteria (190 ug/L).

Overall, results for metals in water samples showed concentrations higher in the Spokane River when compared to other waterbodies (Hallock, 2010b; Hallock, 2011). In a statewide evaluation of concentrations of arsenic, cadmium, chromium, copper, lead, nickel, silver, and zinc in water samples, Hallock (2010b) found dissolved metals higher in eastern Washington than in western Washington. The Stateline Bridge samples from the Spokane River located at the Idaho border had dissolved metal concentrations, (all metals combined, median-normalized), above the 75th percentile of the body of ambient metals data and more than 75% of results were greater than reporting limits. Dissolved lead and zinc were much higher in the Spokane River than elsewhere making the comparison of metal concentrations more pronounced in the eastern Washington Rivers. The evaluation also found dissolved zinc appears to have a baseline concentration around 30 ug/L at the lowest flows.

Suspended Particulate Matter Samples

Results from fall 2009 and spring 2010 samples ranged from 135 – 1,091 mg/kg for lead and 1,090 – 4,088 mg/kg for zinc in the Nine Mile Dam and Stateline sites. Highest concentrations of lead and zinc were found at the Spokane River Idaho border site overall, which agreed with the water sample metal results above.

Concentrations of lead were high compared to other waterbodies (Meredith and Furl, 2010; Meredith and Roberts, 2011) and much higher than background levels found during a freshwater sediment reference study in Washington State. Zinc concentrations appear high also. The sediment reference study sampled bottom-sediments from nine lakes resulting in lead and zinc concentrations ranging from 3.18 – 55.4 mg/kg (average 13.6 mg/kg) and 23 – 110 (average 62.2 mg/kg), respectively (Sloan and Blakely, 2009).

Ecology developed guidelines to identify contaminant levels in sediments at which possible biological effects might occur by using the Lowest Apparent Effects Threshold (LAET) (Cubbage et al., 1997; Betts, 2003). The 2003 LAETs are 335 mg/kg for lead and 683 mg/kg for zinc. Comparing the results from the fall 2009 and spring 2010 sampling, one sample from the

Nine Mile Dam site and all samples from the Stateline site were above this threshold for lead and all samples for both sites were above the threshold for zinc.

Other SPM results (arsenic and cadmium) ranged from not detected to 23.7 mg/kg for arsenic and not detected in either sampling period for cadmium, falling near or below background levels. Two arsenic results, one from spring 2009 and one from spring 2010 sampled at the Nine Mile Dam site were above background bottom-sediment levels for Washington waterbodies (16.9 mg/kg). No cadmium results were above the 1.01 mg/kg background level. All arsenic and cadmium results fell below LAETs thresholds for arsenic (31.4 mg/kg) and cadmium (2.39 mg/kg).

Relationships

Previous monitoring efforts suggest existence of strong relationships among flow, metals concentrations, and TSS. During high flows, the dominant water in the Spokane River coming from the Coeur d'Alene system upstream of the Washington border is likely carrying re-suspended bank and bed sediment that are contaminated by historical mining (Hallock, 2010b). At low flow, the river contains a higher percent of groundwater (MacInnis et al., 2009). Seasonality, loading potential, and trends using these correlations have been reported where sufficient data is available (Hallock, 2010b; Meredith and Furl, 2010; Meredith and Roberts, 2011).

Meredith et al. (2010 and 2011) found lead concentrations by volume (particulate results divided by volume of filtered water (ug/L)) were significantly higher in the spring than in the fall ($p \leq 0.005$), likely driven by higher flows, which brought higher TSS (Table 4). Zinc was found higher in the spring than in the fall also. Arsenic and cadmium results were not detected in the spring but were found at low levels in the fall in some samples.

Table 4. Averaged Particulate Fraction Seasonal Comparison.

SPM by Volume (ug/L)	Spokane R. at Nine Mile Dam		Spokane R. near Idaho Border	
	2009 Fall	2010 Spring	2009 Fall	2010 Spring
Lead	0.1905	0.899	0.6	1.3605
Arsenic	0.0255 J	0.0795 J	0.0 U	0.0955 U
Cadmium	0.0235 U	0.076 U	0.0 U	0.0955 U
Zinc	2.865	6.05	3.4	6.495

Average results were qualified same as original results, except where one site had a mix of nondetects (U) and detected results, averaged results were qualified "J".

There appear to be strong indications that concentrations of total and dissolved cadmium, lead, and zinc are decreasing in the Spokane River. This observation is based on a review by Hallock (2010b) and a larger dataset than presented in this document, of which the 2009 water sample results are a part of. This decrease may be partially a result of declining trends in flow, though the trend in flow is not statistically significant. Variability in flow data and metal data as it relates to flow makes trend detection difficult.

Semipermeable Membrane Devices

PBDEs

Total PBDE results (dissolved) from SPMDs in the Spokane River ranged from 33 – 240 pg/L for 2009 fall and 2010 spring. Highest concentrations (240 pg/L) were found at the Nine Mile Dam site in the fall of 2009. Other waterbodies sampled for the PBT Trends Study generally had results below 50 pg/L. PBDE concentrations in the Spokane River at Nine Mile Dam have been consistently 5 to >10 times higher than other waterbodies statewide (Johnson et al., 2006; Sandvik, 2009; Sandvik, 2010b; Sandvik and Seiders, 2011). These elevated concentrations at this site are typically found in the fall samples. Statewide, seasonal patterns are not apparent at any of the other monitoring sites (Johnson et al., 2006; Sandvik, 2009; Sandvik, 2010b). There is insufficient data available to compare the seasonal observation with the Spokane River Idaho border sampling location, although concentrations remained lower (< 50 pg/L) for both fall (2009) and spring (2010) than at Nine Mile Dam.

PCBs

Results for total PCBs (dissolved) ranged from 46 – 140 pg/L for fall 2009 and spring 2010 SPMD samples in the Spokane River. Higher PCB concentrations were found in the spring 2010 samples for both Spokane River sampling sites. Previous PBT trend results from SPMDs (2007 – 2009), found total PCB concentrations in statewide waterbodies ranged from 5.4 – 130 pg/L (dissolved). The Spokane River and the Lower Columbia River generally had higher PCB levels than other sites.

Certain PCB congeners were identified as common contributors to field-trip blanks. Field samples also contained these same congeners at similar concentrations except for PCB-011. Several field samples showed levels of PCB-011 contributing greater than 20% to total PCBs (Sandvik and Seiders, 2011). Recent studies are reporting PCB-011 to be a global inadvertent pollutant from production of pigments or dyes (Dingfei and Hornbuckle, 2010; Muñoz, 2007; Rodenburg et al., 2010). In the Spokane River samples discussed here, PCB-011 contributed 6% and 32% in the Spokane River Nine Mile Dam samples and 2% and 3% in the Idaho border samples for 2009 and 2010 respectively for each site. All blanks had <2% contribution of PCB-011. The high contributions of PCB-011 found in field samples compared to the low contributions in field-trip blanks suggests PCB-011 may be from a current local source rather than part of the background PCBs.

Whole water concentration (sum of dissolved and particulate) PCB results ranged from 120 – 410 pg/L. For comparative purposes only since no SPMD data are used for regulatory action, whole water concentrations were compared to the Washington State and national human health criterion for PCBs. All total concentration results for both Spokane River sites in 2009 and 2010 except one (the 2009 fall Spokane River border site) did not meet the Washington human health criterion of 170 pg/L. All total concentration results from fall 2009 and spring 2010 samples for the Spokane River were above the EPA national recommended human health criterion of 64 pg/L. Like dissolved results, higher total concentrations were found in the spring 2010 samples likely as a result of higher TOC in the spring associated with higher TSS and flows.

Caution should be taken when comparing SPMD results among different studies or determining trends because of high variability found in the sampling system (Sandvik and Seiders, 2011).

Conventional Parameters

Table 5 shows result ranges for conventional parameters, which include temperature, conductivity, TSS, TOC, flow, and pH.

Table 5. Ranges of Ancillary Results Collected During Fall 2009 and Spring 2010 Sampling in the Spokane River.

Site	Sample Event	Parameter	Range
Spokane R. at Nine Mile Dam	2009 fall	Temperature (C°)	13.1 - 16.8
		Conductivity (us/cm)	215 - 290
		TSS (mg/L)	1 - 2
		TOC (mg/L)	nd - 1.3
		Flow (geometric mean cfs)	1,300
		pH	8.2 - 8.4
Spokane R. near Idaho Border	2009 fall	Temperature (C°)	17.5 - 22
		Conductivity (us/cm)	46 - 52
		TSS (mg/L)	nd - 2
		TOC (mg/L)	1.3 - 1.7
		Flow (geometric mean cfs)	1,036
		pH	7.6 - 8.1
Spokane R. at Nine Mile Dam	2010 spring	Temperature (C°)	8.8 - 15
		Conductivity (us/cm)	84 - 109
		TSS (mg/L)	2 - 4
		TOC (mg/L)	1.5 - 1.6
		Flow (geometric mean cfs)	9,696
		pH	7.5 - 7.88
Spokane R. near Idaho Border	2010 spring	Temperature (mean C°)	7.8 - 14.8
		Conductivity (us/cm)	48 - 52
		TSS (mg/L)	1 - 2
		TOC (mg/L)	1.5 - 1.9
		Flow (cfs)	9,722
		pH	7.4 - 7.71

TSS: total suspended solids.
TOC: total organic carbon.
nd: not detected.

Recommendations

- Monitoring for metals (lead, cadmium, and zinc), PBDEs, and PCBs in the Spokane River should be continued in water, SPM, and SPMDs.

- Sampling locations should include Nine Mile Dam and near the Idaho border. An additional sampling site(s) should be considered in-between these two locations for some parameters such as PBDEs and PCBs. The Spokane River aquifer interchange should be considered when selecting a site(s).

- Address potential use of PCB congener pattern matching techniques to help identify current local sources in the Spokane River. For example, a reduction of PCB-011 may have a favorable reduction to total PCBs.

- Use information from this monitoring to help design an effectiveness monitoring program for toxics in the Spokane River.

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cc: Gary Arnold, EAP-ERO
Jim Ross, EAP-ERO
Lisa Brown, HWTR-ERO
Jim Bellatty, WQ-ERO
Dave Hallock, EAP-HQ
Mike Hibbler, TCP-ERO
Brandee Era-Miller, EAP-HQ

Appendix A. Monitoring Site Descriptions

Table A-1. Monitoring Site Descriptions, Fall 2009 and Spring 2010.

Site Description	Sample	River Mile (RM)	Latitude[1]	Longitude[1]	WBID[2] WA-	Field ID[3]
			Decimal Degrees	Decimal Degrees		
Spokane River at Nine Mile Dam	SPMDs	RM 58.1	47.7747	-117.5444	WA- 54-1020	SPOK and REPSPOK
Spokane River at Nine Mile Dam	SPM	RM 58.1	47.7747	-117.5444	WA- 54-1020	SPOKNM-PB
Spokane River at Nine Mile Dam	Water	RM 58	47.7767	-117.5448	WA- 54-1020	54A090
Spokane River near Idaho Border	SPMDs	RM 98.3	47.6942	-117.0094	WA- 57-1010	SPOKBD
Spokane near Idaho Border	SPM	RM 96	47.6948	-117.0513	WA- 57-1010	SPOKBD-PB
Spokane River near Idaho Border	Water	RM 96.35	47.6985	-117.0446	WA- 57-1010	57A150

1 - North American Datum 1983 is horizontal datum for coordinates.

2 - Ecology's Water Body Identification Number (WBID).

3 - Site identification as used in Ecology's Environmental Information Management system.

SPM = suspended particulate matter.

SPMDs = semipermeable membrane devices.

Appendix B. Ecology SOPs

Table B-1. Ecology SOPs for Sample Collecting and Processing.

Collection Method	Parameters	Reference to Ecology's SOPs
Whole Water Grab Sample	total and dissolved metals: lead, arsenic, cadmium, zinc, hardness	Ward 2007a, Ward 2007b
SPM	lead, arsenic, cadmium, zinc	Meredith 2008
SPMDs	PBDEs, PCB congeners	Johnson 2007b
Whole Water Grab Sample	TOC, TSS	Ward 2007b
TidbiTs	water temperature	Bilhimer and Stohr 2008
Field Measurement	water temperature	Nipp 2006
Field Measurement	pH	Ward 2007b
Field Measurement	conductivity	Ward 2007b

Flow information and data were obtained from Ecology's Environmental Assessment Program Freshwater Monitoring Unit, USGS, and other sources.

Appendix C. Analytical Methods, Reporting Limits, and Final Results Reported.

Table C-1. Laboratory and Measurement Procedures.

Analysis	Sample Matrix	Sample Prep Method	Analytical Method	Reporting Limit
PBDEs	SPMD extract	dialysis/GPC[1]	EPA 8270[2]	2 ng/Sample
PCB congeners	SPMD extract	dialysis/GPC[1]	EPA 1668A[3]	0.1 ng/Sample
Lead	SPM	EPA 3050B	ICP/MS EPA 200.8	1 mg/Kg dw[4]
Arsenic	SPM	EPA 3050B	"	1 mg/Kg dw[4]
Cadmium	SPM	EPA 3050B	"	1 mg/Kg dw[4]
Zinc	SPM	EPA 3050B	"	1 mg/Kg dw[4]
Lead, dissolved	whole water	field filter	"	0.02 µg/L
Arsenic, dissolved	whole water	field filter	"	0.1 µg/L
Cadmium, dissolved	whole water	field filter	"	0.02 µg/L
Zinc, dissolved	whole water	field filter	"	1 µg/L
Lead, total	whole water	acid digest	"	0.1 µg/L
Arsenic, total	whole water	acid digest	"	0.1 µg/L
Cadmium, total	whole water	acid digest	"	0.1 µg/L
Zinc, total	whole water	acid digest	"	5 µg/L
Hardness	whole water	-	SM 2340B	0.3 µg/L
TOC	whole water	-	SM5310B	1 mg/L
TSS	whole water	-	SM2540D	1 mg/L

1. EST SOPs E14, E15, E19, E21, E32, E33, E44, E48.
2. GC/MS SIM = gas chromatography / mass spectrometry applying selective ion monitoring.
3. HRGC/HRMS = high resolution gas chromatography / high resolution mass spectrometry.
4. Assuming 0.5 g of field sample.

GPC = gel permeation chromatography.
dw = dry weight.

Results are reported as follows:

- Metal concentration results from water samples are reported in ug/L and hardness as mg/L. Water quality monitoring results are not considered finalized until the annual report is published, which is generally June of the following year. The 2009 fall and the 2010 spring results are finalized as of the printing of this report. These reports compare results to Washington Water Quality Criteria and are mentioned in this report.

- SPM laboratory results are reported in ug/filter. Final results are reported as mg/Kg dry weight. SPM results are also calculated based on volume as ug/L by dividing the laboratory-reported ug/filter value by the volume of water passed through the filter. SPM results (mg/Kg) were compared to the Lowest Apparent Effects Threshold (LAET) in freshwater sediments.

- The SPMD results are reported as total ng/sample as found in the entire extract; a 5-membrane composite. Residues are blank-corrected for background contamination as described in Appendix D before estimating water concentrations. Estimates of average water column concentrations are reported by using a USGS Estimated Water Concentration spreadsheet and PRCs. PRC loss rates are used to derive an exposure adjustment factor (EAF) to calibrate for the effects of temperature, water velocity, and biofouling. More information can be found through Huckins et al., 2006 and at wwwaux.cerc.cr.usgs.gov/SPMD/index.htm. Water concentration is reported as pg/L (dissolved).

- Total PCB is the sum of the individual congeners. Total PBDE is the sum of the 13 congeners analyzed in this study. Non-detect results were treated as zero when summing compounds. Summed compounds were calculated from water concentration values (as opposed to the residue concentration).

- Currently, SPMD and SPM data are not used for 303(d) listing purposes or other direct regulatory actions. Comparison with water quality standards and other threshold levels in this report are for comparative purposes only. SPMD total water concentrations results (dissolved plus particulate fractions) were compared to the Washington human health criterion and EPA national recommended human health criterion for PCBs. Total concentrations for SPMD results were estimated using the relationship from TOC developed by Meadows et al., 1998 and Karickhoff's (1981) estimation for K_{oc}. There are no criteria for PBDEs.

Appendix D. Data Quality Summary

Performance of laboratory analyses is governed by quality assurance and quality control (QA/QC) protocols. A QAPP developed for each study establishes a data quality guideline for accuracy, bias, and reporting limits with measurement quality objectives (MQOs) (See QAPP references listed in the Methods section).

Manchester's (MEL) quality assurance (QA) program includes the use of quality control (QC) charts, check standards, laboratory surrogates, in-house matrix spikes, laboratory replicates, and laboratory blanks, along with performance evaluation samples. For a more complete discussion of laboratory QA, see MEL's *Quality Assurance Manual* (MEL, 2006) and their *Lab Users Manual* (MEL, 2008).

To determine if MQOs were met, the project lead compared results on field and laboratory QC samples to the MQOs. Based on these assessments, a review of the laboratory data packages, and Manchester Laboratory's data verification reports, the data were either accepted, accepted with appropriate qualifications, or rejected. A summary of field and laboratory data quality are presented below. For more discussion of specific data quality, refer to each projects' annual report as mentioned above.

Field

Field Blanks

Field filter blanks were taken during each sampling period at one of the sample locations: one for SPMs and one for water samples. In the fall of 2009, a SPM field blank was taken at the Idaho border site and a whole water field blank at the Nine Mile Dam site. In the spring of 2010, a SPM field blank was taken at the Nine Mile Dam site and a whole water field blank at the Stateline border site. All results were below reporting limits except one water sample blank result. Dissolved zinc reported 1 ug/L in the water sample field blank taken during the 2010 spring sampling event. Since all results for this report are > 5ug/L, no qualifiers were applied (Hallock, personal communication, 2010a; Hallock, 2011).

A SPMD field trip blank was taken at the Nine Mile site during both sampling events. The field trip blank consisted of five membranes manufactured identically as for field samples. The blank was exposed to the site's ambient air for two minutes during deployment and again during retrieval of the field samples. Low levels of contaminants were found in both fall 2009 and spring 2010 field trip blanks. Sample results were evaluated and a blank-correction procedure used, where possible, before residue results were used for estimating water column concentrations (see below).

Field Replicates

There were no field replicates taken for SPM or water samples from the Spokane River. Field replicates for lead were taken from other sites during the routine sampling for SPM. High variability was indicated by half the lead replicate results outside the MQOs (± 50% RPD) during the fall 2009 and spring 2010 sampling events.

A SPMD field replicate was deployed at the Nine Mile Dam location in the spring of 2010, but not during the fall of 2009. Results from the replicate were rejected due to a lab accident. Historical field replicates generally showed good precision having RPDs less than 20% for over 80% of the residue results (Sandvik 2009 and 2010b). Replicates deployed specifically at the Nine Mile Dam location in the spring of 2009 and fall of 2010 had good precision with over 90% of PBDE and PCB residue results having RPDs of 20% or less (Sandvik and Seiders 2011).

TidbiTs

To determine if SPMDs remained submerged throughout the sampling period, an Onset StowAway® TidbiTs™ temperature monitor was attached to each SPMD canister. Another TidbiT™ was secured out of the water near the site. These TidbiT™ recorded temperature every two minutes. Examination of data from TidbiTs™ showed that all samples remained submerged during deployment.

Laboratory

All samples were prepared and analyzed within the methods holding times for the various parameters. Most QC procedures and corresponding samples fell within the acceptable limits. Exceptions were qualified as estimates when necessary and are briefly discussed below. One 2010 spring SPMD sample was rejected due to a laboratory accident; sample 1006021-15. Laboratory case narratives are available upon request for the project officers.

Metals

Matrix Spikes

The matrix spike and matrix spike duplicate recoveries for hardness analysis in the 2009 fall samples were below the acceptable criteria. Since the spike was insufficient for the elevated concentration of analyte in the field sample, no action was taken. All other associated matrix spike recoveries were within the acceptable limits.

SPM

All QC results were within acceptable limits. No additional qualitative action was needed.

SPMDs

Laboratory Blanks

Analytical laboratory method blanks showed no significant contamination for any of the chemicals analyzed. Individual PCB and PBDE compounds were detected in processing blanks. Concentrations of individual target chemicals in the blanks were inconsistent. Some of these same compounds were found at similar levels in the field trip blanks, suggesting a combination of laboratory and field sources. Although the contamination source is unclear, a certain background level appears to exist and has been documented in previous reports (Sandvik, 2009; Sandvik, 2010b, Sandvik and Seiders 2011). Blank correction for background contamination is briefly described below. WSTMP annual reports for monitoring PBTs with SPMDs describe the blank correction procedure used for each sampling period in more detail.

TSS and TOC

All results for TOC and TSS met QA limits except for two TSS samples. TSS results were qualified as estimates because the samples had fast settling sand.

PCBs

All calibration standards were within the QC limits with a few exceptions. However, as the OPR recoveries were acceptable, no action was taken.

Each congener reported as detected met the isotopic abundance ratio and retention time criteria for positive identification with several exceptions. These exceptions have been qualified to reflect tentative identification, and the associated numerical value represents its approximate concentration; qualified NJ. The values reported for these congeners were not included in the totals for the corresponding homolog.

A number of congeners were qualified as estimates (J) because the concentration was below the lowest calibration standard. Also, low levels of certain target compounds were detected in the laboratory blanks. All corresponding concentrations were qualified as nondetects with an estimated reporting limit (UJ) because the values were below the reporting limit (0.02 ng/sample) and less than 10 times that of the corresponding method blank.

Target analyte recoveries were within method QC of 50% to 150% with several exceptions. Also, certain unlabeled analytes that were not deliberately spiked into an on-going precision and recovery (OPR) or laboratory control sample (LCS) were detected. These results and analytes were also found in field and laboratory blanks indicating certain background contamination of PCBs.

PBDEs

Sampling periods, (2009 fall and 2010 spring), had excellent QA results for PBDEs. Only one QA result for PBDE-138 in the 2010 spring samples required qualification (J) because of slightly low surrogate responses; sample 1006021-19.

Correction for Background Contamination (or Blank-Correction)

The sample results were screened to determine if they could be blank-corrected. Results that were greater than the mean plus two standard deviations of the field trip blank were deemed correctable. Correctable results were adjusted by subtracting the mean of the field trip blanks from the result; the adjusted results were then qualified as an estimate with an unknown bias (JK). For detected compounds that did not meet the blank-correction criteria, the original result was used as an estimated reporting limit and qualified as being below the method detection limit with an unknown bias (UJK). The detection limit was used where a compound was not detected.

The fall sampling event in 2009 provided only one field trip blank. This result was assumed to represent the mean background contamination for that period because the samples were in the same waterbody (the Spokane River) and reasonably close in proximity (approximately 26 miles apart). The standard deviation of the fall field trip blank was estimated using the proportion of the standard deviation to the mean of the 2009 spring field trip blanks, which consisted of seven blanks. The assumption was made that the proportion of standard deviation to mean for one sampling period is similar to another sampling period. Even though this approach limits representativeness, the assumption seems fair, based on the review of the spring and fall field trip blank results.

The impact of the correction process varied among the chemical groups. For the combined 2009 fall and 2010 spring PBDE results, 42% were detected, and of those detected, 59% were correctable. For 2009 fall and 2010 spring PCBs, 84% were detected with 67% of those correctable.

Some results fell below the original reporting limit after they were blank-corrected. These results were considered detected at the "new" corrected level in the remainder of this report.

PCBs, Dioxins, and Furans in Fish, Sediment, and Wastewater Treatment Plant Effluent from West Medical Lake

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Publications Coordinator
Environmental Assessment Program
P.O. Box 47600, Olympia, WA 98504-7600
Phone: (360) 407-6764

Washington State Department of Ecology - www.ecy.wa.gov/

o Headquarters, Olympia	(360) 407-6000
o Northwest Regional Office, Bellevue	(425) 649-7000
o Southwest Regional Office, Olympia	(360) 407-6300
o Central Regional Office, Yakima	(509) 575-2490
o Eastern Regional Office, Spokane	(509) 329-3400

Cover photo: West Medical Lake looking from south to north (photo by Randy Coots).

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by

Randy Coots and Casey Deligeannis

Toxics Studies Unit
Environmental Assessment Program
Washington State Department of Ecology
Olympia, Washington 98504-7710

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Abstract

The Washington State Department of Ecology conducted a toxics study of West Medical Lake between February and October 2008. Six fish tissue, seven sediment, and four Medical Lake wastewater treatment plant (WWTP) effluent samples were collected. The toxics analyzed included polychlorinated biphenyls (PCBs), 2,3,7,8-tetrachlorodibenzodioxin (TCDD or dioxin), and other chlorinated dioxins and furans. Additional conventional parameters analyzed included lipids in fish tissue, total organic carbon and grain size in sediments, and total suspended solids and total organic carbon in WWTP effluent.

Total PCB concentrations in fish tissue were generally low compared to statewide levels. However the Environmental Protection Agency National Toxic Rule (NTR) human health criterion was still exceeded by a factor of 2 to 8. Tissue concentrations of dioxins/furans were low, and TCDD was not detected.

Total PCBs and dioxins/furans in sediment were below apparent effects thresholds for the protection of benthic infauna based on Washington State's proposed freshwater Sediment Quality Guidelines.

Total PCBs in WWTP effluent were low and below the NTR criterion for human health throughout the study period. In the April sample, TCDD was reported just above the reporting limit, exceeding the NTR criterion. The April results may be related to the WWTP upset in the de-nitrification system. No furans were reported above detection limits.

Recommendations include:

1. Consider changing the West Medical Lake 303(d) listing for TCDD from Category 5 (on the list) to Category 1 (meets standards) during the next water quality assessment (year 2012).
2. Re-analyze West Medical Lake rainbow trout in five years to assess levels of PCBs, dioxins, and furans.
3. Analyze PCBs, dioxins, and furans in rainbow trout at the time of planting to determine if there is contamination from hatchery sources prior to introduction to the West Medical Lake.

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  - Chris Donley's knowledge of the lake and help with collecting fish was much appreciated.
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- Washington State Department of Ecology staff:
  - Ken Merrill proposed and helped develop the study and also assisted in collecting sediment samples.
  - Karin Baldwin took over the project and was helpful in defining the final product.
  - Dale Norton and Art Johnson reviewed the document.
  - Joan LeTourneau and Cindy Cook prepared the final report.

Introduction

In 2002 the Washington State Toxic Monitoring Program (WSTMP) collected samples of rainbow trout from West Medical Lake. One composite of fillet from 10 fish was analyzed. Results from this sample were responsible for placing West Medical Lake on the 2004 303(d) list for total polychlorinated biphenyls (PCBs) [listing ID: 42173] and 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) [listing ID: 42381].

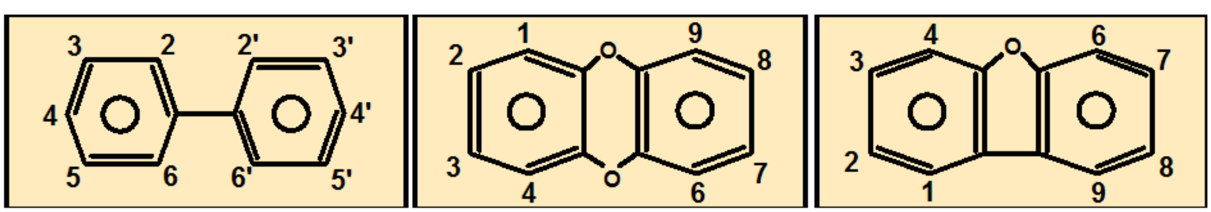
Since that time the 303(d) listing policy has changed resulting in using only the concentration of 2,3,7,8-TCDD. The WSTMP sample that justified the 303(d) listing in 2004 was based on 2,3,7,8-tetrachlorodibenzofuran (TCDF).

The federal Clean Water Act requires that waterbodies on the 303(d) list be cleaned up by pollution control programs or that a total maximum daily load (TMDL) be developed. A pollution-control program needs to address the sources of pollution and have a monitoring and enforcement component. A TMDL identifies pollution problems in the watershed and specifies how much pollution needs to be reduced or eliminated to achieve clean water. When developing a pollution-control program or a TMDL, Ecology will work with the local community and other relevant stakeholders to identify all actions that need to occur to address the sources of pollution. Monitoring to assess the effectiveness of those implementation actions will also be developed. That monitoring will be used to determine success or the next steps needed.

303(d) Parameters

PCBs, dioxins, and furans are similar in structure and are classes of organic chemicals that are persistent, bioaccumulative, and toxic. They can remain in the environment for many years and move between water, air, soil, and sediments. With the ability to move between these media, they threaten the food chain and can accumulate in animals and humans. Higher detection levels are typically reported from fish tissue and sediment (parts per billion) than water (parts per trillion or quadrillion) because of the hydrophobic nature of these contaminants.

Figure 1 shows the structure and numbering system of PCBs, dioxins, and furans. The numbered locations are chlorine bonding sites.



Polychlorinated biphenyls (PCBs) | Polychlorinated dibenzo-p-dioxin (PCDD) | Polychlorinated dibenzofuran (PCDF)

Figure 1. Structure and Numbering System of PCBs, Dioxins, and Furans.

PCBs

PCBs are synthetic organic compounds with no natural sources. PCBs enter the environment through their use and disposal. The commercial value of PCBs was based on their chemical stability and electrical insulating properties. Use largely focused around coolants and lubricants in transformers, capacitors, and other electrical equipment. Production of PCBs was banned by the Environmental Protection Agency (EPA) in 1979.

PCBs are normally analyzed as congeners or Aroclors. Congeners are individual chlorinated biphenyl molecules that are identified by the number and location of chlorine atoms around the biphenyl rings joined by a carbon-carbon bond. There are a total of 209 PCB congeners possible. Aroclors are commercial mixtures of congeners based on the application and the desired properties. Detection limits are higher for Aroclor analysis.

Dioxins and Furans

Dioxins and furans are the common names associated with polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF). These compounds are formed as an unintended byproduct during combustion of organic compounds in the presence of chloride. Sources are waste incinerators, pulp mills, industrial processes, and even backyard burn barrels. There is no commercial or domestic use for dioxins or furans. Ecological effects can occur because of their persistence and ability to biomagnify in the food chain.

There are a total of 210 possible dioxin and furan congeners. Like PCBs they are identified by the number and location of chlorine atoms around the biphenyl rings, but in this case, joined by oxygen atoms (Figure 1). The highest toxicity is associated with the 17 co-planar congeners (7 dioxin and 10 furan) that have chlorine atoms located in the 2,3,7, and 8 positions. The most toxic of these congeners is 2,3,7,8-TCDD.

Watershed Description

West Medical Lake is located within the Upper Crab Creek watershed in eastern Washington about 15 miles southwest of Spokane. Forming the western boundary of the City of Medical Lake, the shoreline surrounding the lake is largely natural. A picnic area is located on the east shore, and a large public access with boat rentals and docks is on the south shore (Figure 2). The land surrounding the lake is owned by the state with no near-shore residential development. The drainage area to West Medical Lake is mainly agriculture with wheat fields the major land use.

West Medical Lake is one of the few lakes in Washington State receiving a National Pollutant Discharge Elimination System (NPDES) permitted discharge. Nutrient levels in the lake are elevated, classifying it as “highly eutrophic”. It may be one of the most enriched lakes in the state (Smith et al., 2000). Aquatic plants are thick in most places. Zooplankton support one of the most productive trout fisheries in the state (Donley, 2008). The Washington Department of

Fish and Wildlife (WDFW) have operated aerators in the past to maintain adequate dissolved oxygen levels and prevent fish kills. West Medical Lake is not normally used for primary contact recreation.

Draining a relatively small basin of about 1.8 $miles^2$, West Medical Lake has approximately 4 miles of shoreline, a surface area of 220 acres, and an average depth of 22 feet. With no natural inflows or outflows, the hydraulic residence time of this seepage lake is very long, estimated at about 29 years (Willms and Pelletier, 1992).

The arid climate of eastern Washington averages about 80 degrees from June through August. From December through February the average high is about 35 degrees. Annual precipitation is slightly more than 16 inches per year. Elevation of West Medical Lake is 2,420 feet above sea level.

Water Quality Standards and Guidelines

Fish Tissue and WWTP Effluent

In 1992, EPA established water quality criteria for the protection of human health from the adverse effects of priority pollutants. The criteria are called the National Toxics Rule (NTR) (40 CFR 131). The Clean Water Act required states without sufficient human health criteria for priority pollutants to adopt the National Toxics Rule. Human health criteria are calculated for an increased lifetime cancer risk of one in one million (10^{-6}) from the consumption of fish or water. Water quality criteria for the toxic parameters addressed in this study for West Medical Lake are shown below in Table 1.

Table 1. Washington State Water Quality Criteria for PCBs and 2,3,7,8-TCDD.

Chemical	Criteria for Protection of Aquatic Life - Freshwater		Criteria for Protection of Human Health		
	Acute (ng/L)	Chronic (ng/L)	Water and Fish Consumption (ng/L)	Fish Consumption (ng/L)	Fish Tissue
Total PCBs	2,000	14	0.17	0.17	5.3 *u*g/Kg
2,3,7,8-TCDD			0.000013	0.000014	0.065 ng/Kg

Sediments

Washington State has not formally adopted regulatory numeric standards or EPA criteria for chemical contaminants in freshwater sediments. Instead, recommended numerical Freshwater Sediment Quality Values (FSQVs) are used as guidelines. The FSQVs are intended for the protection of sediment-dwelling organisms from toxic effects of chemical contaminants.

Avocet (2003) has developed FSQVs as both Sediment Quality Standards (SQS) and Cleanup Screening Levels (CSL) for Washington State. The SQS are concentration thresholds below which biological effects are not expected. The CSL estimates the concentration below which minor adverse effects can occur and above which more significant effects are likely.

The FSQVs presented below in Table 2 have been developed from field studies and laboratory data. The most recent SQS guidelines for use in Washington State are shown for PCBs (Avocet, 2003) and TCDD (Cubbage et al., 1997). In addition, two other sets of FSQVs for total PCBs from the state of Florida (Florida DEP, 2003) and Ontario, Canada (Jaagumagi and Persaud, 1999) are shown. The Florida value is consensus-based and developed using five threshold effect guidelines developed by MacDonald et al. (2000). Differences in proposed guideline values lie in the different chemical mixtures present in sediments and the biological effect from them.

Table 2. Recommended Numerical Guidelines for Total PCBs and TCDD in Freshwater Sediments from Washington State, Ontario, and Florida.

Guideline		Reference
Total PCBs (*ug*/Kg, dw)		
Washington State [1]	62	Avocet, 2003
Ontario [2]	70	Jaagumagi and Persaud, 1999
Florida [3]	60	Florida DEP, 2003
TCDD (ng/Kg, dw)		
Washington State [4]	8.8	Cubbage et al., 1997

[1] - Reported as LAET, “Lowest Apparent Effects Threshold”.
[2] - Reported as LEL, “Lowest Effect Level”.
[3] - Reported as TEC, Consensus-based “Threshold Effects Concentration”.
[4] - Reported as AET, “Apparent Effects Threshold”.

Potential Sources of Contamination

Historical Discharges

Historically, two facilities discharged treated wastewater directly to West Medical Lake:

- Eastern State Hospital and Lakeland Village, operated by the Washington State Department of Social and Health Services.
- Pine Lodge Corrections Center for Women, operated by the Washington State Department of Corrections.

Discharges from these state facilities were rerouted in October 2000 and connected to the City of Medical Lake’s new wastewater treatment plant (WWTP).

Permit Holders

Under the NPDES Waste Discharge Permit and Reclaimed Water Permit No. WA-0021148, the City of Medical Lake is authorized to discharge reclaimed water to West Medical Lake. The effective date of the permit was June 1, 2005 and expiration was April 27, 2010. A new permit is expected by the end of summer 2010.

The current NPDES permit does not address discharge limits for total PCBs or TCDD. The design flow is for an average maximum discharge per month of 1.85 million gallons per day (mgd).

The Medical Lake WWTP provides tertiary treatment by activated sludge, coagulation, and filtration. Following tertiary treatment, effluent is divided and discharged to a tributary of Deep Creek and West Medical Lake. The West Medical Lake portion is discharged by way of a manifold extending from the eastern shoreline at the historical WWTP to almost the center of the lake as reclaimed water for augmentation and maintenance of the lake's water level. During the dry season WWTP discharge to West Medical Lake averages between 0.4 and 0.5 mgd, and during the wet season the discharge averages between 0.7 and 1.0 mgd (Cooper, 2007).

Nonpoint Sources

There are a number of possible nonpoint (diffuse) sources of PCBs and TCDD to West Medical Lake. Air deposition is a likely contributor from both local and global sources. Entering the air during manufacture, use, and disposal, airborne contaminants such as PCBs and TCDD can travel long distances before being deposited back to the earth's surface.

Waste burning of materials containing PCBs and TCDD contributes to the airborne pool of contaminants available as fallout to land and water surfaces. Uncontrolled combustion is thought to be a major source of PCBs and TCDD today. Anything from backyard trash burning to industrial incinerators can be considered a potential source. A recent EPA study (EPA, 2006) found that residential burning of household trash is a leading source of dioxins to the air. Agricultural burning and forest fires are also thought to contribute dioxins.

Because of the persistent nature of PCBs, contaminant levels found in West Medical Lake today could be partly a result of past improper or illegal handling as well as disposal of transformers and other electrical equipment containing PCBs.

Stormwater runoff from Eastern State Hospital, Lakeland Village, other facilities within the drainage area, and agricultural lands may also be playing a role as a source of PCBs and TCDD to the lake. In addition to direct deposition from the air, PCBs and TCDD can bind to soils and wash off to surface waters during storm events.

Lake sediments may also play a role as an internal source of pollutants to the food chain. Historical discharges to the lake from the state facilities, in addition to other ambient sources, have likely contributed to sediment contamination.

Figure 2. Study Area.

Methods

Overview

This study was conducted under the guidance of the Quality Assurance Project Plan (QAPP) entitled *West Medical Lake Total PCBs and Dioxin (2,3,7,8-TCDD) Total Maximum Daily Load* (Coots, 2008), which can be found at: www.ecy.wa.gov/pubs/0803104.pdf . Sampling locations for the study are shown below on Figure 3. Analytical methods, reporting limits, and sample preparation are presented in Table 3.

Study objectives included:

- Evaluating current levels of total PCBs and TCDD in fish tissue, sediment, and WWTP effluent.
- Providing the fish tissue data to the Washington State Department of Health to evaluate the need of a fish consumption advisory.

These objectives were met through characterizing the current levels of PCBs and TCDD in edible fish tissue and sediments from West Medical Lake. Seasonal loads of PCBs and TCDD were also monitored for the Medical Lake WWTP discharge to the lake.

The current West Medical Lake 303(d) listings for PCBs and TCDD are based on rainbow trout tissue, so they were targeted for collection and analysis. Rainbow trout are the dominant species in the lake. WDFW stocks the lake with 150,000 to 300,000 rainbow trout annually (Donley, 2008). The planting consists of catchable size fish, as well as some brood stock and triploids. Carry-over fish two or more years of age were targeted for collection.

The Washington State Department of Health was consulted during study development to ensure the number of fish targeted for collection would meet the needs of a fish consumption advisory evaluation.

Medical Lake WWTP loads of total PCBs and TCDD discharged during the 2008 study year were calculated from results reported for seasonal effluent samples and the flow rate from the WWTP at the time of sampling. Maximum loads for total PCBs and TCDD were also developed using the water quality criteria for each contaminant and sample time flows for the Medical Lake WWTP facility.

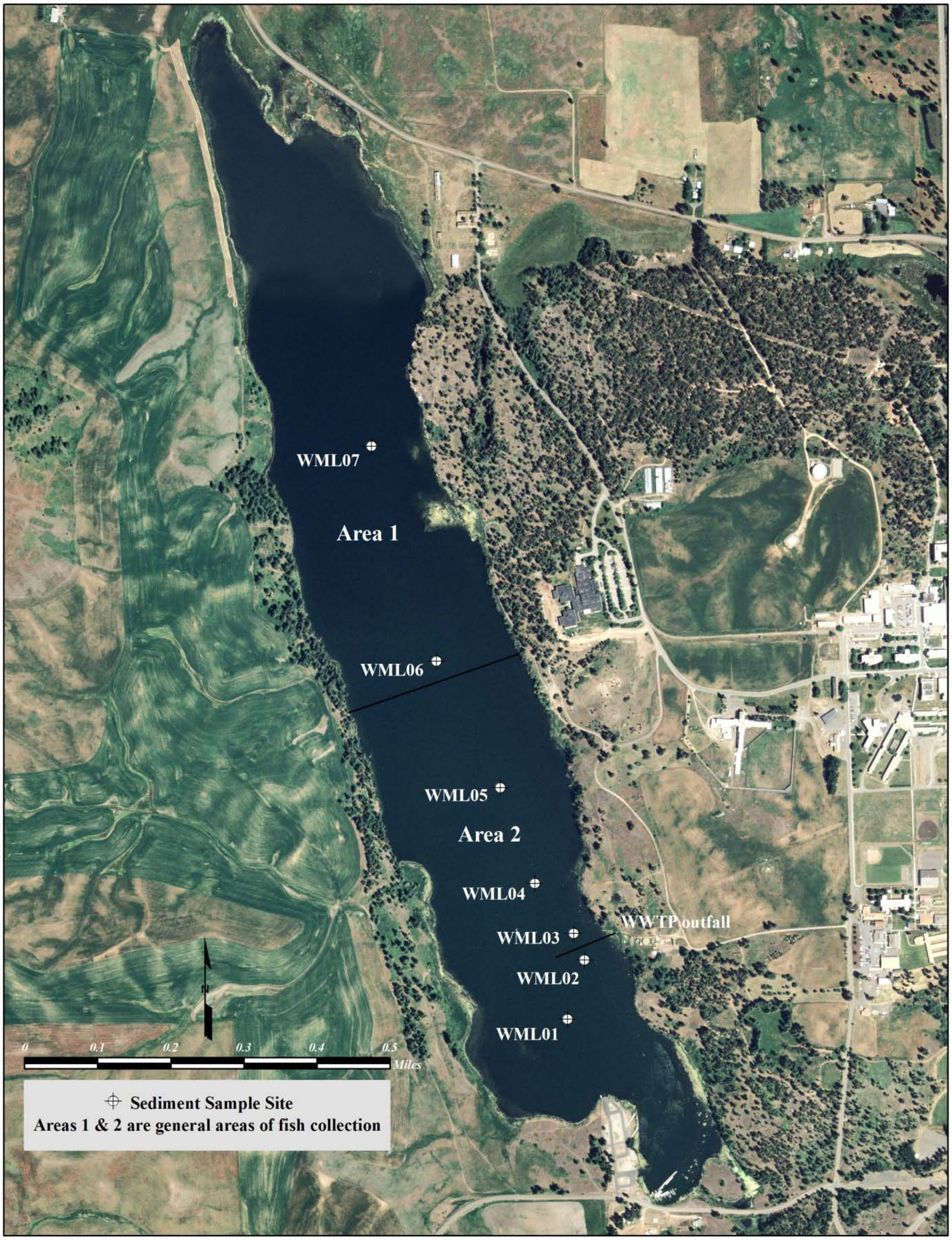


Figure 3. Sediment Collection Sites and Fish Collection Areas.

Table 3. Methods for Fish Tissue, Sediment, and WWTP Effluent Sample Analysis.

Analysis	Reporting Limit	Sample Preparation Method	Analytical Method
Fish Tissue			
PCB Aroclors	5 *u*g/kg, wet	EPA 3541	EPA 8082
Dioxins/Furans	0.07 ng/Kg, wet	Silica-gel if needed	EPA 1613B
Percent Lipids	0.10%	Extraction	EPA 1613 B
Sediment			
PCB Aroclors	5 *u*g/kg, dry	EPA 3541	EPA 8082
Dioxins/Furans	0.05 ng/Kg, dry	Silica-gel if needed	EPA 1613B
Total Organic Carbon	0.10%	Combustion/NDIR	PSEP-TOC
Grain Size	0.10%	Sieve and Pipette	PSEP-1986
Effluent/Water			
PCB Congeners	10 pg/L	EPA 1668A	EPA 1668A
Dioxins/Furans	1 pg/L	EPA 1613B	EPA 1613B
Total Organic Carbon	1 mg/L	NA	SM 5310B
Total Suspended Solids	1 mg/L	NA	SM 2540D

NDIR – non-dispersive infrared detector.
NA – not applicable.
PSEP-TOC – Puget Sound Estuary Program – Total Organic Carbon.
SM – Standard Methods.

Fish

WDFW biologists routinely collect fish from West Medical Lake so Ecology took the opportunity to coordinate fish sampling for the project. Fish were collected by gill net in April 2008. The two fish collection areas are shown on Figure 3. Biological information for the individual fish collected for the study is presented in the Appendix, Table B1.

The lake was divided into two areas based on its general configuration and location of the NPDES discharge: (1) North lake (Area 1) and (2) South lake (Area 2) where the WWTP discharge is located (Figure 3). Rainbow trout (*Oncorhynchus mykiss*) were collected from each area for analysis.

A total of six composite fish tissue samples were collected from the lake, three from each of two sampling areas. Two of the three composites from each area were from the year-one age class, hold-overs from the previous year. These composites were made of five fish each. The third composite from each area was of larger fish ranging in age from two to three years. The larger fish composite from the north area was made from four fish, while the south area composite was made from two fish.

Composite fish tissue samples were made from equal weight portions of individual fish. The samples were homogenized to a uniform color and consistency. The composites were divided into the appropriate sample containers for PCB aroclor equivalents, dioxins and furans, and lipid analysis.

Sediment

A survey of West Medical Lake surface sediments was conducted to establish baseline conditions for PCBs, dioxins, and furans. The spatial extent and levels of these pollutants in sediment were previously unknown. A total of seven sediment samples were collected during April 2008. Two samples were collected adjacent to the WWTP outfall, with the remainder as transect collected at increased distances from the outfall (Figure 3). Coordinates of sample locations and general descriptions of sediment grabs are included in Appendix B, Table B2.

Sediment samples were collected from a Wooldridge 16-foot aluminum jet sled using a 0.05 m^2 stainless-steel Ponar grab and hand-crank davit. Samples were composites made from three separate grabs. A grab sample was considered acceptable if it was not overfilled, overlying water was present but not overly turbid, the sediment surface appeared intact, and the grab reached the desired sediment depth. When the grab was considered acceptable, overlying water was siphoned off and sub-sampling was initiated. Equal volumes of the top 2-cm of each grab was used as the sample.

Each composite sample was homogenized to a uniform color and consistency using dedicated stainless-steel spoons and bowls. Debris on the surface or sediment contacting the sides of the Ponar grab was not retained. Composites were divided into the appropriate sample containers for PCB aroclor equivalents, dioxins and furans, total organic carbon (TOC), and grain size.

WWTP Effluent

Effluent samples from the Medical Lake WWTP were collected on four occasions: once each in February, April, July, and October of 2008. Collection locations for sampling were the same as for NPDES requirements, just prior to effluent discharge. The July and October samples were collected from a sample port on the effluent line entering the lake at Eastern State Hospital's remnant WWTP. The February and April samples were collected as final effluent from the WWTP disinfection chamber. A temporary upset in the WWTP de-nitrification system in February and the lake level peaking in April required all effluent to be discharged to Deep Creek, as required in the NPDES permit.

The WWTP samples were collected as composites of the final effluent. To avoid the possibility of contamination by automatic samplers, grab samples were hand composited. Effluent composites consisted of four grabs, two collected in the morning (8:00 AM) and two collected in the afternoon (4:00 PM), during two consecutive days. The composite samples were analyzed for PCB congeners, dioxins and furans, TOC, and total suspended solids. Flow data were obtained from WWTP records.

Quality Assurance

Ecology's Manchester Environmental Laboratory prepared quality assurance reviews for all chemical data. Data are reviewed for qualitative and quantitative accuracy following the EPA National Functional Guidelines for Organic Data Review. Data were evaluated for adherence to sample holding times, instrument calibration, results for process blanks, duplicate analysis, recovery of surrogates, labeled compounds and matrix spikes, and laboratory control samples analyses.

Overall, a review of the data quality control and quality assurance from laboratory case narratives indicates the data are usable as qualified by Manchester Laboratory (MEL, 2008). Most data met measurement quality objectives established in the Quality Assurance Project Plan (Coots, 2008).

MEL performed all analyses within recommended holding times.

Results reported from analysis of quality control samples for PCB Aroclors in fish tissue and sediment met established quality control limits. No target analytes were detected in laboratory blanks.

Due to weathering and metabolic breakdown, PCB Aroclor patterns can differ from the analytical reference standards used for identification. If the relative standard deviation (RSD) between peaks used to quantify Aroclors exceeds 40%, results are reported as estimates ("J"). All results for Aroclor 1254 and 1260 in fish tissue were "J" flagged as estimates.

Sediment samples 08144050 and 08144051 had recovery of the surrogate decachlorobiphenyl reported just below the 50-150% limit. Aroclors detected in these sediment samples were qualified as estimates ("J").

A number of PCBs, dioxins, and furans were positively identified in effluent below the lowest calibration standard. When this occurred, these results were qualified as estimates ("J"). Recoveries for target analytes in laboratory control samples, calibration standards, and labeled reference compounds were within method specified quality control limits.

A field transfer blank was analyzed for dioxins and furans. None of the seventeen 2,3,7,8-chlorine substituted congeners were detected.

Several PCB, dioxin, and furan congeners were detected in method blanks. When analytes were also detected in the sample at less than 10 times the blank level, the sample result was qualified as not detected at an estimated concentration ("UJ").

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Results and Discussion

Fish

Biological statistics for fish collected during the study can be found in Appendix B, Table B1. Information for fish weight, length, sex, age, and field and laboratory identification of samples is presented. Figure 3 shows the two general areas where fish were collected.

Rainbow trout were targeted for sampling because they are the dominant species in West Medical Lake, the basis of the 303(d) listings, and a popular sport fish. Results from the analysis of fillets are shown in the Appendix B, Table B3 for PCB Aroclors and Table B4 for dioxins and furans. Three composite samples from each of the two collection areas of the lake were analyzed. Two of the three composites were comprised of layover fish planted the previous year. The third composite was of larger fish made up of hatchery brood stock or triploids, both routinely planted by WDFW.

PCBs

Total PCB Aroclors in rainbow trout fillets were generally low, averaging 24 *u*g/Kg (parts per billion) wet weight and ranging from 12 to 44 *u*g/Kg for all samples. The NTR human health criterion for total PCBs is 5.3 *u*g/Kg which was exceeded by a factor of 2 to 8. Aroclor PCB-1254, the most common Aroclor reported in fish tissue, was detected in all samples. Only one other Aroclor was detected: PCB-1260 was found in the large fish composite from the south lake area (sample 08214015).

The two composites of larger fish (08214012 and 08214015) had roughly twice the total PCB concentration as the four composites of smaller fish. The mean total PCB concentration of the four composites of smaller fish was 16.5 *u*g/Kg, while the mean for the two composites of larger fish was 40 *u*g/Kg.

The total PCB results from rainbow trout samples collected for this 2008 study were compared to total PCB data from rainbow trout collected statewide from 1993 to 2008, by Ecology and EPA. These data are available from Ecology's Environmental Information Management (EIM) system. The database contains all data monitored by, or required by, Ecology or recipients of Ecology grants.

The EIM data represent total PCBs in rainbow trout fillet from 107 sites over 15 years. Only total PCB results reported above detection limits are presented. Figure 4 presents a cumulative frequency plot displaying data as percentiles. Units on the Y axis are micrograms per kilogram (*u*g/Kg – parts per billion) of total PCBs plotted on a logarithmic scale. Levels of total PCBs measured in West Medical Lake rainbow trout fall between the 23rd and 60th percentile for all rainbow trout collected between 1993 and 2008 in Washington State. Composites of the smaller fish fall between the 23rd and 45th percentiles, while composites of the larger fish (samples 08214012 and 08214015) were at the 56th and 60th percentiles.

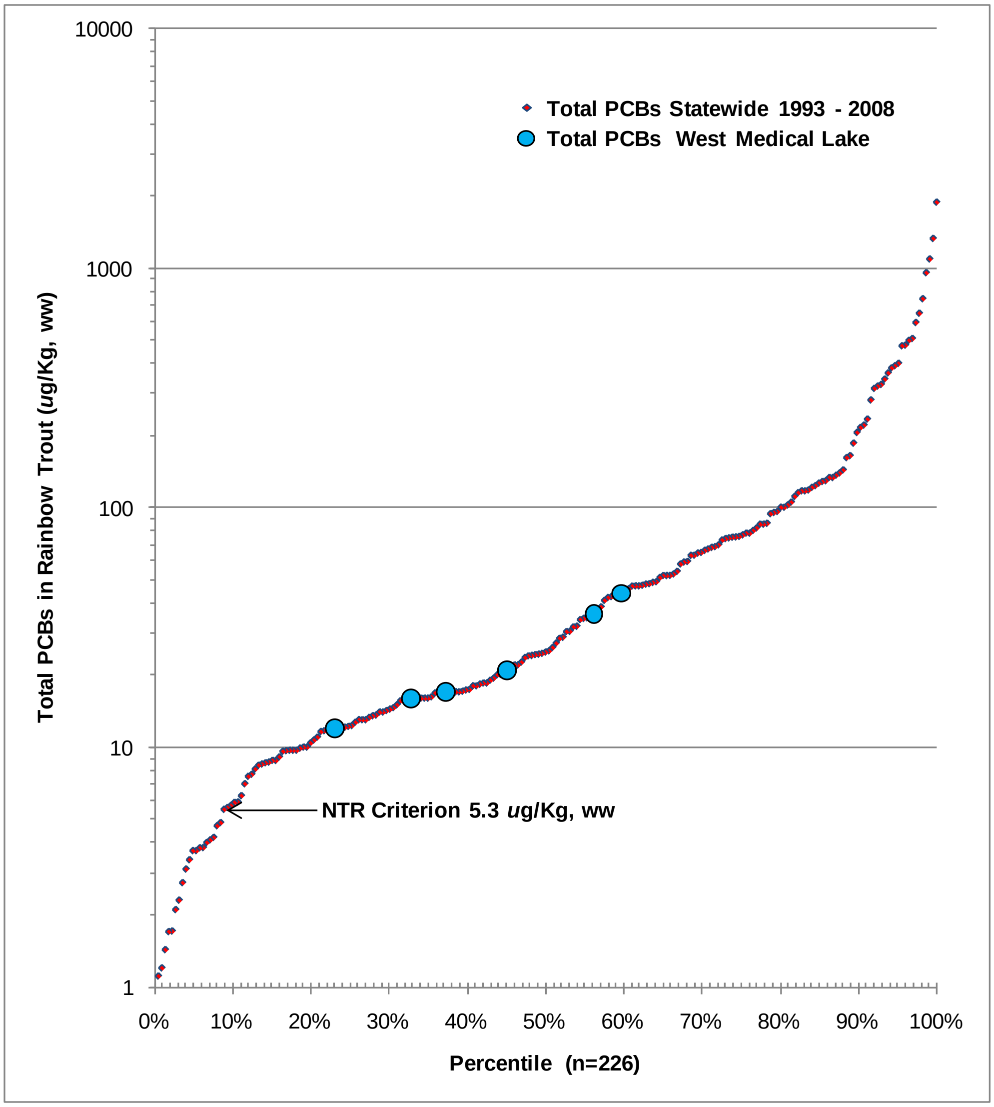

Figure 4. Cumulative Frequency Distribution of Total PCBs in Rainbow Trout Fillets Collected in 2008 from West Medical Lake Compared to Statewide Data for 1993-2008.

Fish food used at some WDFW hatcheries has recently been suspected of containing significant levels of PCBs and other persistent organic pollutants. A recent Ecology study reported some hatchery and planted fish contained concentrations of PCBs that may be above regulatory criteria (Serdar et al., 2006). West Medical Lake was not a part of the study, and it is not known if planted fish were affected by the contaminated fish food reported at some WDFW hatcheries (Donley, 2008).

Dioxins and Furans

The more highly chlorinated dioxins and furans were detected in the fish tissue samples. For dioxins, only the octa- congener was detected, while furans detected included the tetra-, penta-, hexa-, hepta-, and octa- congeners.

The levels of dioxins and furans were generally low in fish tissue, Appendix B (Table B4). TCDD the most toxic of the dioxins and furans, was not detected. The only dioxin congener reported above detection limits was octachlorodibenzo-p-dioxin (OCDD), the least toxic of the seven.

To assess the total potential toxicity of dioxins and furans in West Medical Lake fish tissue, toxic equivalent factors[1] (TEFs) were applied to study data (WHO, 2005). The toxicity of each detected congener is determined based on TEFs. Summing the TEF values for all the detected congeners gives a toxicity equivalent quotient (TEQ) which can be compared to TCDD criteria.

Figure 5 shows dioxin TEQs in the rainbow trout samples. TEQs averaged 0.090 ng/Kg (parts per trillion) wet weight, ranging from 0.039 to 0.130 ng/Kg. The NTR human health criterion for TCDD is 0.065 ng/Kg. The largest contributor to the TEQ was TCDF, which has a TEF of 0.1. The TCDF contribution to the total TEQ of each fish composite ranged from 71 to 93%.

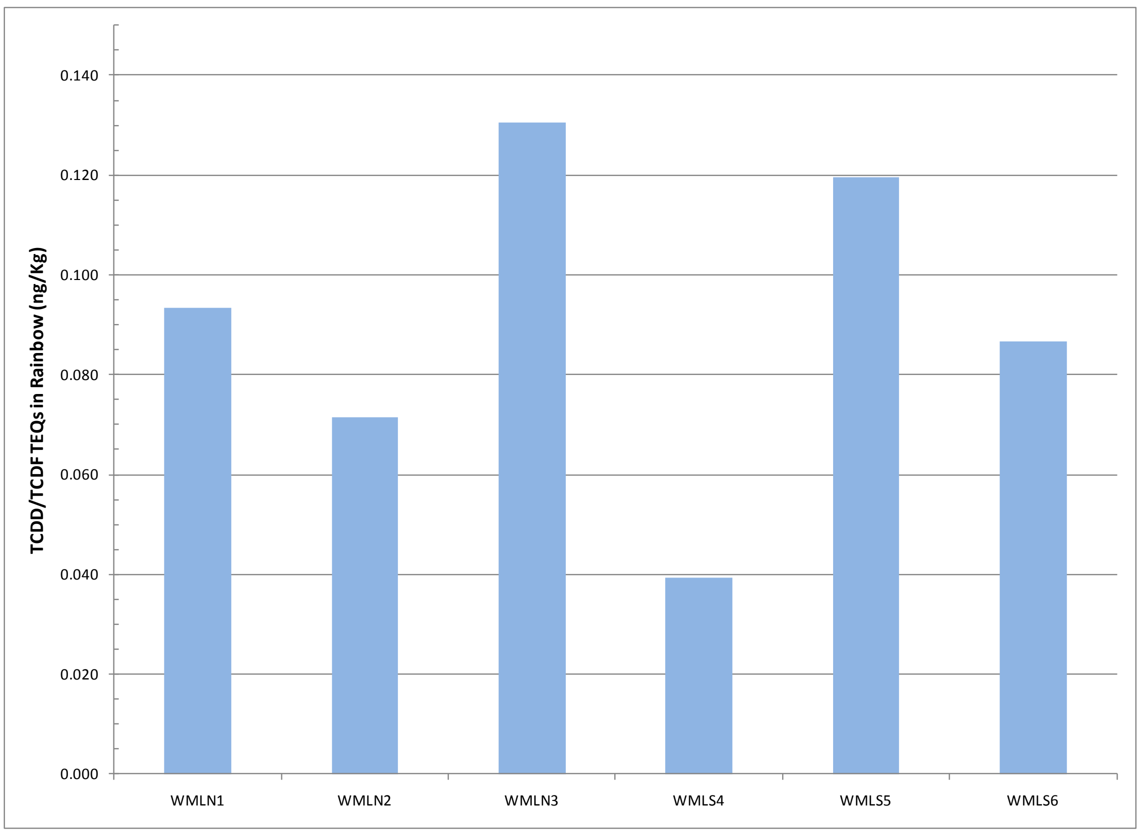

Figure 5. Dioxin TEQs in Rainbow Trout Tissue from West Medical Lake.

[1] 2,3,7,8-TCDD is the most toxic of the dioxin or furan congeners and is given a TEF of 1. Each of the other 16 dioxin/furan congeners of concern are given a TEF that is a decimal fraction of 1 based on the relative toxicity compared to 2,3,7,8-TCDD. TEFs are multiplied by the congener concentrations and summed to give a TEQ which can be compared to criteria for 2,3,7,8-TCDD.

Comparison to Previous Study

The WSTMP study results, responsible for the 303(d) listings for PCBs and dioxins/furans, (Seiders and Kinney, 2004) are compared to the results from this study in Table 4. The mean total PCBs in fish reported for this study was about a third less than the levels reported for the WSTMP fish. The composites of smaller fish from this study were lower in concentration, averaging less than one half the levels reported in the larger fish composites. The dioxin/furan TEQs were similar between studies, and no 2,3,7,8-TCDD was detected. Current 303(d) listing policy is to use the concentration of TCDD only, as the other dioxins and furans or TEQs are not addressed in the standards.

Table 4. Comparison of 2008 PCBs and PCDD/PCDF TEQs in fish tissue to WSTMP Data and NTR Criteria.

Study	Total PCBs (*u*g/Kg, ww)	PCDD/PCDF TEQ (ng/Kg, ww)	2,3,7,8-TCDD (ng/Kg, ww)	Lipids (percent)
Present study 2008	24.0[1]	0.090[1]	0.03 UJ	2.4[1]
Small/large fish composites from 2008	16.5/40.0[2]	0.081/0.11[2]	0.03 UJ/0.03 UJ	2.1/3.2[2]
WSTMP 2002	36.0	0.084	0.52 UJ[3]	2.4
NTR criteria	5.3	-	0.065	-

[1] = Study mean (six composites).

[2] = Mean of four small fish composites/mean of two large fish composites.

[3] UJ = Not detected at the estimated detection limit shown.

Two important factors that drive levels of toxics such as PCBs and TCDD in fish tissue are (1) biomagnification of contaminants through the food chain and (2) water column concentrations. Fish species, size, and age are also important in concentrating persistent toxic chemicals. The PCB and dioxin results reported by WSTMP, placing the rainbow trout on the 303(d) list, were from fish averaging 660 grams (Seiders and Kinney, 2004). The four composites of smaller fish collected for this study averaged only 164 grams, while the two composites of larger fish averaged 736 grams. These larger fish had similar concentrations of PCBs and dioxins as the samples collected by WSTMP that resulted in the 2008 303(d) listing.

West Medical Lake may not be the only source of PCBs and dioxins found in fish. As previously discussed, WDFW hatchery fish have been shown to have significant levels of PCBs from food (Serdar et al., 2006). In addition to the 150,000 to 300,000 catchable-sized rainbows stocked yearly, WDFW also plant brood stock and triploids. It is not known what levels of PCBs or TCDD were in the fish prior to planting or the residence time of the larger fish. So it is not clear what fraction of the PCB and TCDD load was acquired from the lake.

WDOH Human Health Evaluation

The Washington State Department of Health (WDOH) evaluates the human health risk of chemical contaminants in fish and issues advisories when levels of pollutants are a concern. WDOH conducted a Consumption Advisory Assessment of West Medical Lake rainbow trout collected during the 2008 study for total PCBs and TCDD. The assessment was completed in April 2009.

WDOH concluded that, "No restrictions are necessary due to either PCB or dioxin/furan levels in West Medical Lake rainbow trout. Recommended meal consumption rates are based in part on contaminant levels but also incorporate other factors such as background concentrations in rainbow trout or other species in Washington State, levels of contaminants in other foods, nutritional and cultural benefits. Rainbow trout from West Medical Lake would be a good choice for anglers" (McBride, 2009).

This consumption assessment is specifically for rainbow trout from West Medical Lake. Other species of fish that reside in the lake could have different levels or types of contaminants.

Fishery Management

WDFW applied the pesticide, rotenone, to West Medical Lake in October 2009 with the goal of restoring the lake to a trout fishery. Removal of competing populations of undesirable fish allows the WDFW to stock the lake with fry at almost a tenth the cost of planting catchable-sized trout. The beneficial effects are expected to last for six to eight years.

Tench, pumpkinseed sunfish, and possibly gold fish were targeted for removal. These exotic species were illegally planted in West Medical Lake. Following the rotenone treatment, the dead fish were not removed from the lake.

The fish community that this study reports results for no longer exists. Additional sampling would be required to determine current levels of PCBs or dioxins/furans in West Medical Lake fish.

Between March and May of 2010, the lake was replanted with over 160,000 rainbow trout. Four size classes of fish made up the plant: 125,000 fry at about 100 per pound; 35,000 catchable at about five per pound; 1650 triploids at about one and a half pound each; and 600 broodstock at about three pounds each.

Sediment

Surface sediments were collected from seven locations within West Medical Lake along a north to south transect (Figure 3). Two samples bracketed the WWTP outfall, with the remainder collected at increasing distances from the outfall. The sample coordinates, relative location within the lake, water depth at the collection site, and sediment description are presented in Table B2 in Appendix B. The complete set of results for PCBs, dioxins and furans, TOC, and percent fines from West Medical Lake sediments can be found in Tables B5 and B6.

West Medical Lake has been reported as one of the most enriched lakes in the state (Smith et al., 2000). Levels of TOC in surface sediments were high, averaging 6.9% and ranged from 6.1% to 8.0%. Field logs consistently noted sediment grabs had a black color, pudding-like texture, and the odor of hydrogen sulfide (Table B2). The most recent Washington State sediment quality guideline for TOC (Avocet, 2003) recommends TOC no greater than 9.8%.

Grain size results are presented in Figure 6. Particle distribution from site to site was fairly uniform. Samples were comprised largely of fines ranging from 66.4% to 97.2% (fines consist of silts and clays - particle sizes < 62.5 microns). Only the most southern sample (WML01) reported fines less than 75%.

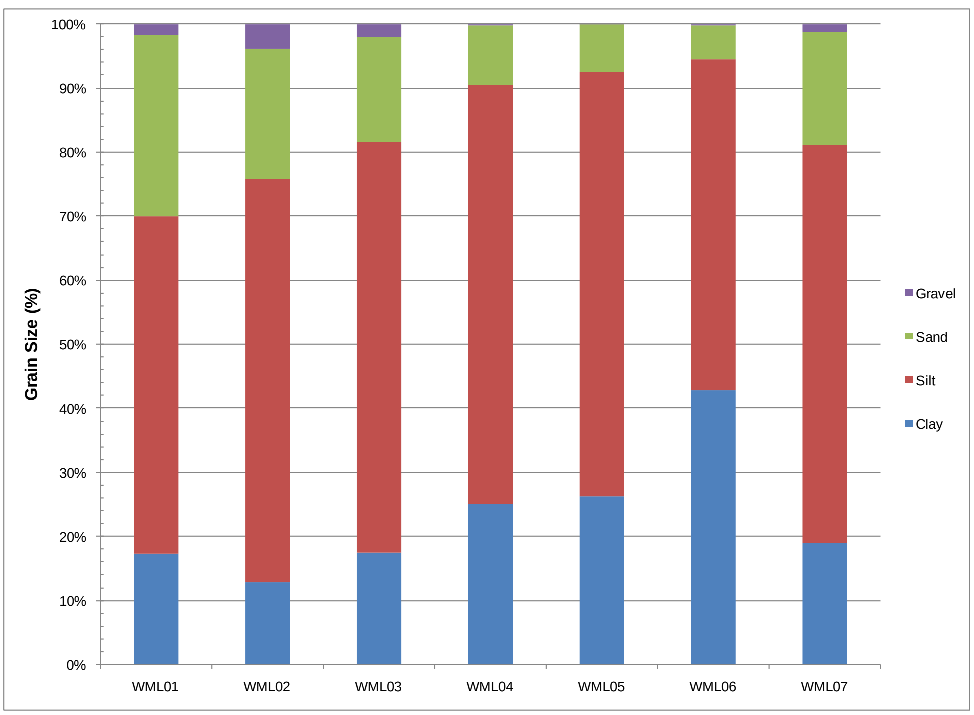

Figure 6. Grain Size Distribution of West Medical Lake Sediments.

PCBs

Sediment PCBs were analyzed as Aroclors. The most frequently detected Aroclors in sediment are PCB-1254 and PCB-1260. In this study only PCB-1254 was detected, in all samples. Levels of PCB-1254 were fairly low, ranging from 9.0 to 19 *ug*/Kg dry weight (dw) and averaging 14 *ug*/Kg dw (Table B5).

PCB levels were similar in sediment collected throughout the lake. Only small differences were found between samples collected adjacent to the WWTP outfall and samples from other sites. The maximum concentration reported from all samples was only twice the minimum. The highest level of PCB-1254 was reported from WML07, the northern most sample site (Figures 7 and 3). This site represented the farthest sample point from the WWTP discharge, suggesting the possibility there may be a source of PCBs entering the north lake area. These results also show WWTP effluent is not creating a PCB hot spot in the area adjacent to the outfall.

The lowest AET for total PCBs in the recommended freshwater sediment quality values for use in Washington State is 62 *ug*/Kg, dw (Avocet, 2003). The total PCB levels found in West Medical Lake's surface sediments average less than a fourth of the AET. This suggests a low probability of harm from PCBs to sediment-dwelling organisms in the top 2 cm of sediments.

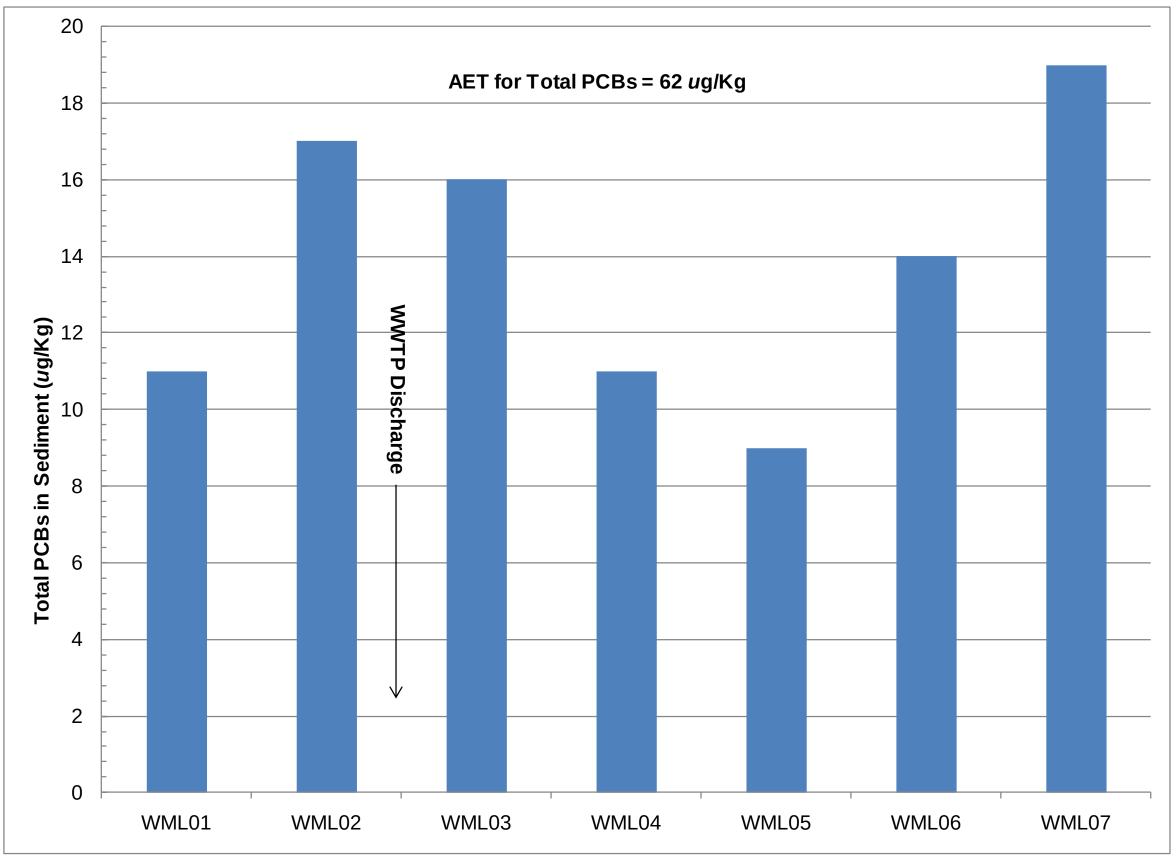

Figure 7. Total PCBs in West Medical Lake Sediments.

At times predictable relationships are identified between results from high-cost analysis for organic analytes and low-cost conventional parameters such as TOC or percent fines. For West Medical Lake, sediment PCBs were found to be only moderately correlated to TOC (r^2 = 0.61) and poorly correlated to percent fines (r^2 = -0.19).

Dioxins and Furans

Concentrations of dioxins and furans in sediment were generally low (Figure 8 and Table B6). 2,3,7,8-TCDD was reported above detection in all samples with a mean of 0.46 ng/Kg dw and ranging from 0.29 to 0.76 ng/Kg. The most recent freshwater sediment quality guideline for 2,3,7,8-TCDD, based on the AET for benthic infauna, is 8.8 ng/Kg dw (Cubbage et al., 1997). Levels of 2,3,7,8-TCDD reported for this study averaged more than an order of magnitude below the guideline concentration. Sediment TEQs ranged from 2.9 to 5.2 ng/Kg and averaged 4.2 ng/Kg, suggesting a low probability of causing harm to sediment-dwelling organisms.

Tetra- to octa-chlorinated dioxins and furans were detected in sediments. The highest concentrations of dioxins were reported in the more chlorinated homologs of the hepta- and octa- groups. The average 2,3,7,8-TCDD contribution to the total TEQ was 11%, and ranged from 8 to 15% (Figure 8). For furans, homologs from the tetra-, hepta- and octa-chlorinated groups were reported having the highest concentrations. The percent contribution of the seven 2,3,7,8-chlorine-substituted PCDDs and ten 2,3,7,8-chlorine-substituted PCDFs to the total TEQ was generally consistent, being about 60% and 40%, respectively (Table B6).

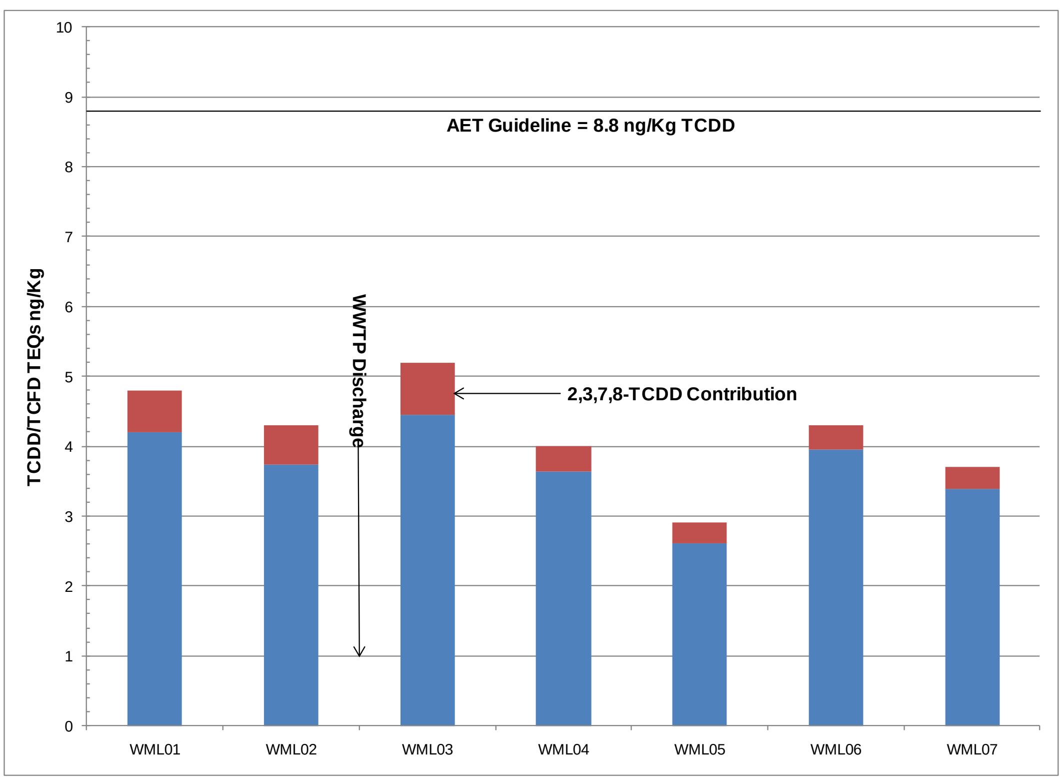

Figure 8. Dioxin TEQs in West Medical Lake Sediments.

WWTP Effluent

Discharge

During 2008 the Medical Lake WWTP discharge ranged between 0.334 and 1.303 million gallons per day (mgd). Flows for the January through June period were variable, ranging between 0.395 and 1.303 mgd. Discharge exceeded 1.0 mgd for a brief period from February 29 to March 17, averaging 1.13 mgd. July through December discharge was more stable, ranging from 0.334 to 0.503 mgd.

The discharge fluctuated seasonally (Figure 9). Influent volumes often increase in the winter and spring, caused by inflow and infiltration from water entering the collection system through joints, breaks, or cracks. Improper domestic connections like roof or foundation drains are other sources that can increase influent flows to the WWTP during winter and spring.

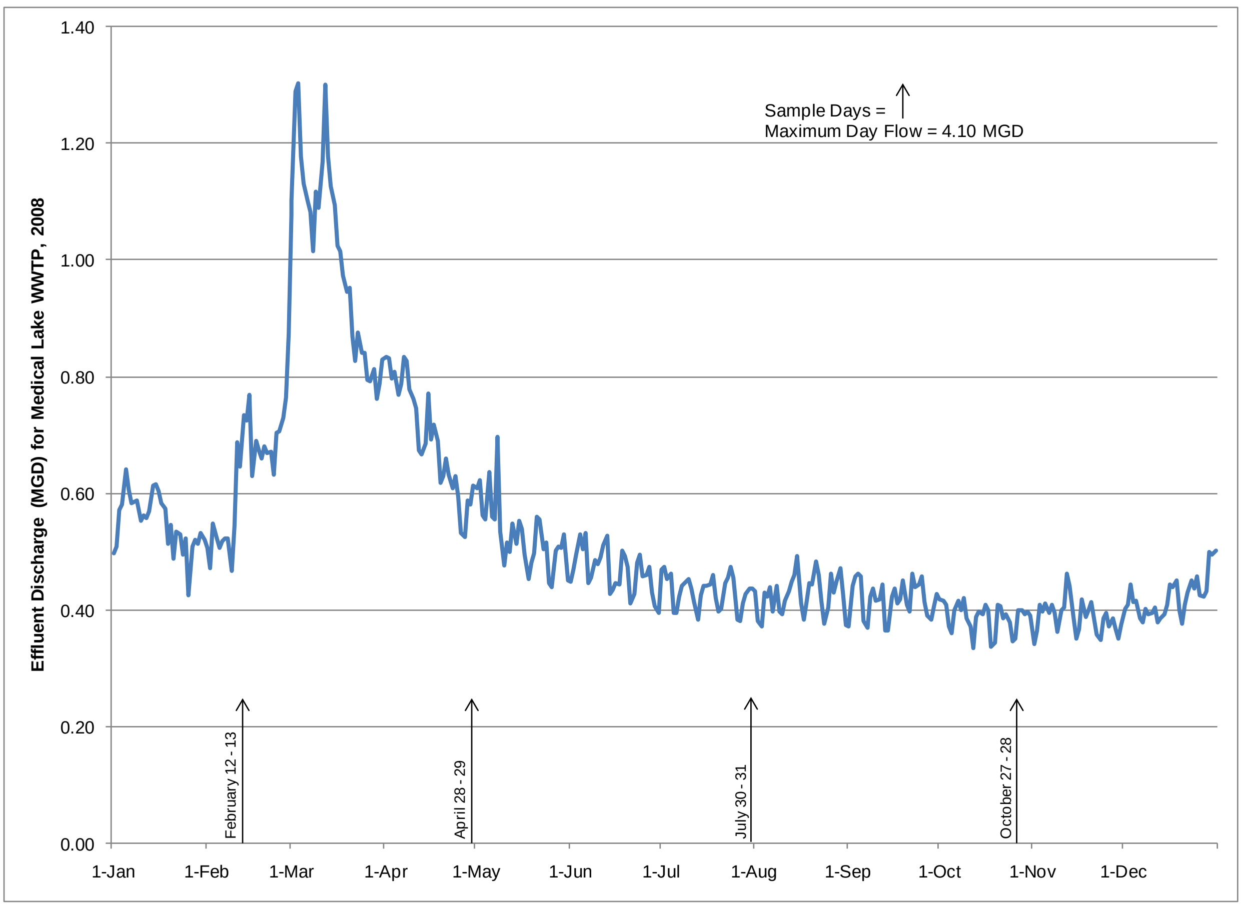

Figure 9. Daily Effluent Discharge from Medical Lake WWTP, 2008.

The Medical Lake NPDES permit (No. WA-0021148) requires effluent to be discharged to three possible locations. The primary outfall is to an intermittent unnamed tributary to Deep Creek. Throughout the year, effluent is discharged down the Deep Creek tributary with a NPDES permit required minimum of 0.10 mgd. The other two discharge locations are Use Area #1, West Medical Lake, for lake level augmentation, and Use Area #2, the City of Medical Lake reclaimed water system uses, such as landscape irrigation. During 2008 the City used reclaimed water between May 8 and October 13, averaging 0.012 mgd.

West Medical Lake has no natural surface inputs or outflows. Evaporation and seepage through the lake bottom or side walls accounts for the majority of lake water loss. Water levels are maintained by receiving effluent as reclaimed water from the Medical Lake WWTP. Effluent is discharged through a manifold located at the remnant Eastern State Hospital WWTP located on the eastern shore (Figure 2). The discharge limit is based on the lake stage. When the lake level reaches the defined maximum, all effluent is discharged to the Deep Creek tributary.

Table B7 in Appendix B presents information on effluent collection times, dates, and locations where samples were collected, in addition to results for TOC and TSS. Results for PCB congeners are shown in Figure 10, and results for dioxins/furans are in Tables B8 and B9.

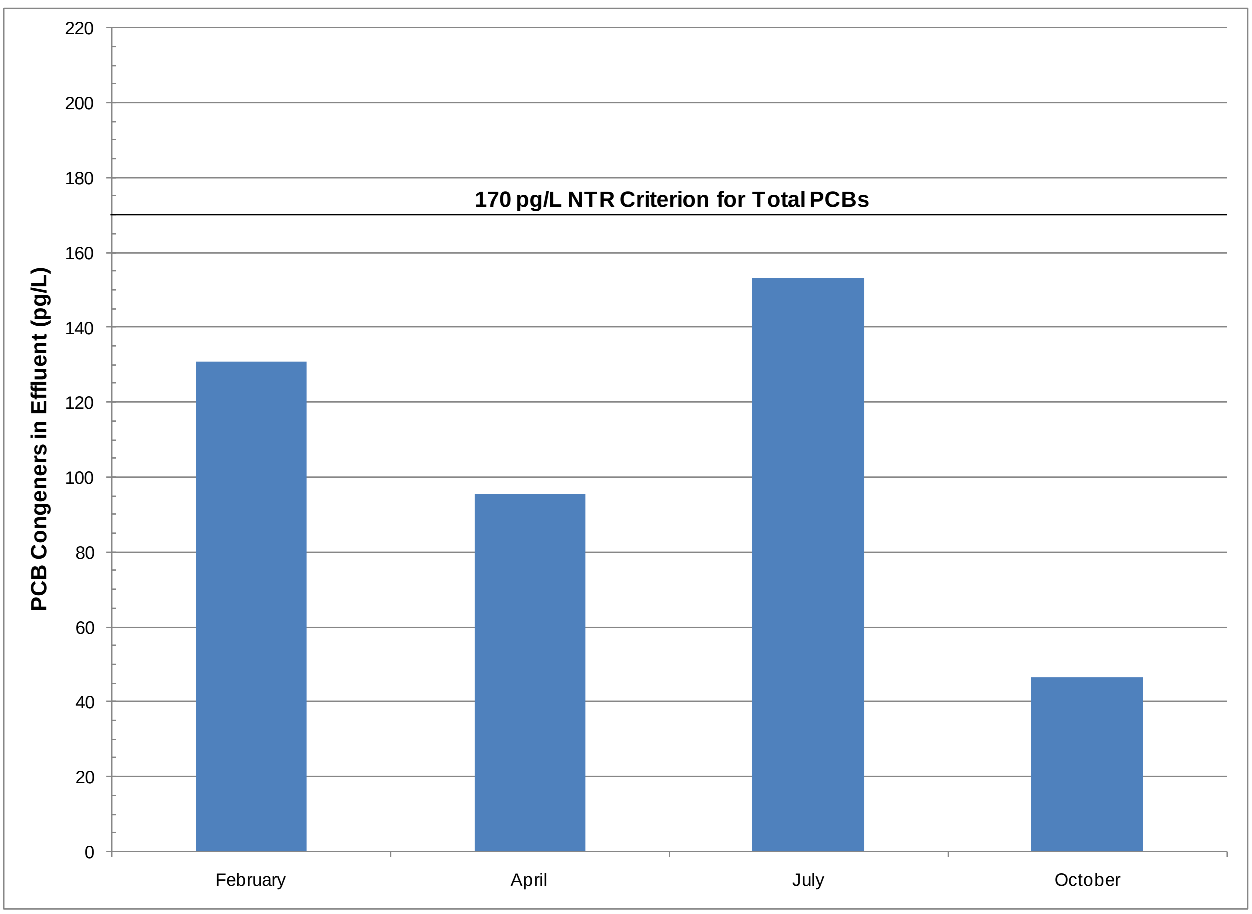

Figure 10. Total PCBs in Medical Lake WWTP Effluent.

PCBs

Table B8 summarizes the results for the PCB homolog groups. Di-, tri-, tetra-, penta-, and hexa-chlorinated homolog groups were detected in effluent samples. Total PCBs averaged 106 pg/L and ranged from 46.6 to 153 pg/L (parts per quadrillion) throughout 2008. This is below the 170 pg/L NTR human health criterion for total PCBs in water. The highest concentration was reported for the sample collected in July, while the lowest concentration was from October. There was no obvious seasonal trend.

Table 5 summarizes the PCB data that have been reported for eastern Washington WWTP effluents since 2001. Concentrations found in seasonal effluent samples from the Medical Lake WWTP are low compared to other WWTPs from areas that include agriculture and urban environments such as the Palouse, Walla Walla, Spokane, and Yakima.

Table 5. Summary of PCB Data for Eastern Washington WWTP Effluents.
(pg/L, parts per quadrillion; mean values)

Receiving Water/ WWTP	Year	N=	Total PCBs	Reference
Palouse River				
Pullman	2007-08	3	1400	Lubliner (2009)
Colfax	2007-08	3	330	
Albion	2007-08	1	1500	
Walla Walla River				
Walla Walla	2002-03	4	790	Johnson et al. (2004)
	2006-07	3	380	
College Place	2002-03	4	1300	Lubliner (2007)
	2006-07	3	300	
Spokane River				
Spokane	2001	2	1800	Golding (2002)
Liberty Lake	2001	2	1700	
Yakima River				
18 facility mean	2007-08	72	580	Johnson et al. (2010)
West Medical Lake				
Medical Lake	2008	4	106	Present study

Dioxins and Furans

Few dioxins and no furans were reported above detection limits (Appendix B, Table B9). The sample collected in April had 2,3,7,8-TCDD reported at an estimated concentration of 0.56 pg/L (parts per quadrillion), just above the 0.50 pg/L reporting limit. This is about 43 times the 0.013 pg/L NTR human health criterion for 2,3,7,8-TCDD. Currently analytical capabilities are not able to reach the 2,3,7,8-TCDD NTR human health criterion. For this study the 2,3,7,8-TCDD reporting limit was 0.50 pg/L or about 38 times the NTR criterion. The large difference between the NTR criterion for 2,3,7,8-TCDD of 0.013 pg/L and the reporting limit of 0.50 pg/L suggests the possibility dioxins could be a concern.

During December 2007 through April 2008, the Medical Lake WWTP suffered an upset in their de-nitrification system. As a result this treatment process was taken off-line. The detection of 2,3,7,8-TCDD in effluent may be related to the upset. The de-nitrification system did not return to normal function until ambient temperatures started increasing in the spring when it was put back on-line.

The only other dioxin compound detected in effluent was OCDD at an estimated concentration of 3.03 pg/L. OCDD is the least toxic of the dioxin congeners, with a TEF of 0.0003 (OCDD TEQ = 0.00091 pg/L).

PCB and TCDD Loads

Chapter 173-201A WAC specifies inflows to West Medical Lake must meet water quality criteria at the point of discharge. This is particularly important to West Medical Lake, a seepage lake without the benefit of a clean natural inflow or outflow to shorten residence time, estimated at 29 years (Willms and Pelletier, 1992).

Water quality criteria are based on the concentration of a contaminant, expressed as a unit measure per volume of water: for example, micrograms per liter (*u*g/L). Determining a contaminant load removes the effects of dilution which can fluctuate throughout the year. Loads are calculated and expressed as a unit measure over a period of time: for example, milligrams per day (mg/day).

During the December and April sample events, all effluent from the WWTP was discharged to the Deep Creek tributary, averaging 0.638 mgd. For the July and October sample events, effluent was split with portions going to both West Medical Lake and the Deep Creek tributary. Total WWTP discharge averaged 0.412 mgd for the July and October periods, with 0.268 mgd going to West Medical Lake and 0.143 mgd to the Deep Creek tributary.

Table 6 presents calculated loads based on concentrations reported for samples collected during the study and effluent flows at the time of sampling. Loads discharged to West Medical Lake and the Deep Creek tributary are shown separately, along with allowable maximums based on the NTR human health criterion and total effluent discharge.

Table 6. Total PCB Loads Discharged and Allowable Loads from the Medical Lake WWTP.

Sample Date – 2007-08	Effluent Discharge to Deep Crk (mgd)	Effluent Discharge to WML[1] (mgd)	Total PCB Congeners in Effluent (pg/L)	Total PCB Load to Deep Crk (mg/day)	Total PCB Load to WML (mg/day)	Total PCB Load Discharged (mg/day)	Total Allowable PCB Load (mg/day)[2]	Percent of Allowable Load
Dec 12-13	0.691	0	131	0.343	0	0.343	0.445	77.1
Apr 28-29	0.584	0	95.3	0.211	0	0.211	0.376	56.1
Jul 30-31	0.120	0.304	153	0.0695	0.176	0.246	0.273	90.1
Oct 27-28	0.167	0.233	46.6	0.0295	0.0411	0.0706	0.257	27.5

[1] - West Medical Lake.
[2] - Allowable load is the WWTP flow rate at the time of sampling and the NTR criterion for total PCBs (170 pg/L).

The percent of total PCBs discharged compared to maximum allowable loads for the sample events ranged from 27.5 to 90.1%. The December sample period discharged the largest total PCB load (0.343 mg/day), and the October event discharged the smallest (0.0706 mg/day).

Only in the April sample was 2,3,7,8-TCDD detected. The maximum allowable load of 2,3,7,8-TCDD based on WWTP discharge at the time of sampling and the human health criterion was 0.029 *u*g/day. The 2,3,7,8-TCDD load discharged to the Deep Creek tributary during April was 1.24 *u*g/day. As previously discussed, sampling occurred during a WWTP upset and this upset is likely related to the sampling results.

Conclusions and Recommendations

Conclusions

The 303(d) listing for total PCBs in edible tissue of West Medical Lake fish should be retained based on data from this 2008 study. The NTR human health criterion for total PCBs was exceeded by a factor of 2 to 8. Although dioxins and furans were also detected, the current policy is to list for TCDD exceedances only. Fish tissue samples from this study did not have TCDD levels above detection limits. On this basis, West Medical Lake no longer qualifies for a 303(d) listing under Category 5 for TCDD.

Based on the WDOH assessment, no fish consumption restrictions are necessary due to either PCBs or dioxin/furan levels. Rainbow trout were found to be a good choice for anglers.

Levels of PCBs, dioxins, and furans in sediment were generally low and below recommended effects thresholds for benthic infauna. It does not appear the WWTP discharge has created a toxic hotspot adjacent to the outfall. The highest PCBs reported in sediments were from a northern site farthest away from the outfall, suggesting a source in the northern area of the lake.

Effluent from the Medical Lake WWTP show total PCBs were low and within the NTR human health criterion. Dioxins and furans were generally not detected except for the sample collected in April when TCDD and OCDD were present just above the limit of detection. From December 2007 through April 2008, the WWTP suffered a process upset in the de-nitrification system. Until warmer weather returned, the de-nitrification system did not return to normal operation and was off-line. These April results may be related to the WWTP upset in the de-nitrification system.

Recommendations

The results of this study support the following recommendations.

- The current West Medical Lake 303(d) listing for 2,3,7,8-TCDD in rainbow trout tissue should be revisited in the 2012 listing cycle for proper category placement based on this study's data.

- West Medical Lake rainbow trout should be analyzed for PCBs, dioxins, and furans in five years for comparison to this study's data.

- Catchable-sized rainbow trout planted by the Washington Department of Fish and Wildlife should be analyzed just prior to planting in West Medical Lake. This should be done to determine contaminant levels in the trout prior to planting in the lake.

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Appendices

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Appendix A. Glossary, Acronyms, and Abbreviations

Glossary

303(d) list: Section 303(d) of the federal Clean Water Act requires Washington State to periodically prepare a list of all surface waters in the state for which beneficial uses of the water – such as for drinking, recreation, aquatic habitat, and industrial use – are impaired by pollutants. These are water quality limited estuaries, lakes, and streams that fall short of state surface water quality standards and are not expected to improve within the next two years.

Ambient: Background (environmental). Away from point sources of contamination.

Benthic infauna: Tiny sediment-dwelling invertebrates (e.g., aquatic insects, worms).

Bioaccumulative pollutants: Pollutants that build up in the food chain.

Clean Water Act: A federal act passed in 1972 that contains provisions to restore and maintain the quality of the nation's waters. Section 303(d) of the Clean Water Act establishes the TMDL program.

Dioxins and furans: Polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans.

Eutrophic: Nutrient rich and high in productivity resulting from human conditions such as fertilizer runoff and leaky septic systems.

Grab sample: A discrete sample from a single point in the water column or sediment surface.

National Pollutant Discharge Elimination System (NPDES): National program for issuing, modifying, revoking and reissuing, terminating, monitoring, and enforcing permits, and imposing and enforcing pretreatment requirements under the Clean Water Act. The NPDES program regulates discharges from wastewater treatment plants, large factories, and other facilities that use, process, and discharge water back into lakes, streams, rivers, bays, and oceans.

Nonpoint source: Pollution that enters any waters of the state from any dispersed land-based or water-based activities, including but not limited to atmospheric deposition, surface water runoff from agricultural lands, urban areas, or forest lands, subsurface or underground sources, or discharges from boats or marine vessels not otherwise regulated under the NPDES program. Generally, any unconfined and diffuse source of contamination. Legally, any source of water pollution that does not meet the legal definition of "point source" in section 502(14) of the Clean Water Act.

Parameter: Water quality constituent being measured (analyte). A physical, chemical, or biological property whose values determine environmental characteristics or behavior.

Pollution: Such contamination, or other alteration of the physical, chemical, or biological properties, of any waters of the state. This includes change in temperature, taste, color, turbidity, or odor of the waters. It also includes discharge of any liquid, gaseous, solid, radioactive, or other substance into any waters of the state. This definition assumes that these changes will, or are likely to, create a nuisance or render such waters harmful, detrimental, or injurious to (1) public health, safety, or welfare, or (2) domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or (3) livestock, wild animals, birds, fish, or other aquatic life.

Sediment: Solid fragmented material (soil and organic matter) that is transported and deposited by water and covered with water (example, river or lake bottom).

Stormwater: The portion of precipitation that does not naturally percolate into the ground or evaporate but instead runs off roads, pavement, and roofs during rainfall or snow melt. Stormwater can also come from hard or saturated grass surfaces such as lawns, pastures, playfields, and from gravel roads and parking lots.

Total Maximum Daily Load (TMDL): Water cleanup plan. A distribution of a substance in a water body designed to protect it from exceeding water quality standards. A TMDL is equal to the sum of all of the following: (1) individual wasteload allocations for point sources, (2) the load allocations for nonpoint sources, (3) the contribution of natural sources, and (4) a Margin of Safety to allow for uncertainty in the wasteload determination. A reserve for future growth is also generally provided.

Watershed: A drainage area or basin in which all land and water areas drain or flow toward a central collector such as a stream, river, or lake at a lower elevation.

Acronyms and Abbreviations

Following are acronyms and abbreviations used frequently in this report.

AET	Apparent effects thresholds
Ecology	Washington State Department of Ecology
EIM	Environmental Information Management database
EPA	U.S. Environmental Protection Agency
NPDES	(See Glossary above)
NTR	National Toxics Rule
OCDD	octachlorodibenzo-p-dioxin
OCDF	octachlorodibenzofuran
PCBs	polychlorinated biphenyls
PCDD	polychlorinated dibenzo-p-dioxins
PCDF	polychlorinated dibenzofurans
TCDD	2,3,7,8-tetrachlorodibenzodioxin
TEF	toxic equivalency factor
TEQ	toxic equivalent quotient (or concentration)
TMDL	(See Glossary above)
TOC	Total organic carbon

WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WDOH	Washington State Department of Health
WSTMP	Washington State Toxics Monitoring Program
WWTP	Wastewater treatment plant

Units of Measurement

dw	dry weight
ft	feet
g	gram, a unit of mass
kg	kilograms, a unit of mass equal to 1,000 grams.
mg	milligrams
mgd	million gallons per day
mg/d	milligrams per day
mg/Kg	milligrams per kilogram (parts per million)
mg/L	milligrams per liter (parts per million)
mL	milliliters
ng/Kg	nanograms per kilogram (parts per trillion)
ng/L	nanograms per liter (parts per trillion)
pg/L	picograms per liter (parts per quadrillion)
ug/Kg	micrograms per kilogram (parts per billion)
µg/L	micrograms per liter (parts per billion)
ww	wet weight

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Appendix B. Study Tables

Table B1. Biological Data on West Medical Lake Rainbow Trout, April 11, 2008.

Site ID	Composite ID	Laboratory ID	Length (mm)	Weight (g)	Fillet Weight (g)	Sex[1] M, F, U	Age
RBT17	WMLN1	08214010	235	132	70	U	1
RBT15	WMLN1	08214010	263	173	87	U	1
RBT10	WMLN1	08214010	254	165	91	U	1
RBT9	WMLN1	08214010	261	158	97	U	ND
RBT1	WMLN1	08214010	281	194	105	U	ND
RBT6	WMLN2	08214011	262	163	85	U	ND
RBT7	WMLN2	08214011	253	162	97	U	1
RBT8	WMLN2	08214011	242	140	84	U	1
RBT12	WMLN2	08214011	276	198	114	M	2
RBT13	WMLN2	08214011	265	165	96	F	1
RBT33	WMLN3	08214012	383	702	183	F	2
RBT34	WMLN3	08214012	438	830	240	M	3
RBT35	WMLN3	08214012	385	701	170	F	2
RBT36	WMLN3	08214012	415	885	233	F	3
RBT21	WMLS4	08214013	253	181	94	U	ND
RBT23	WMLS4	08214013	235	137	80	U	ND
RBT24	WMLS4	08214013	269	178	106	U	ND
RBT27	WMLS4	08214013	250	154	89	U	1
RBT29	WMLS4	08214013	264	179	103	U	ND
RBT22	WMLS5	08214014	263	181	108	U	ND
RBT25	WMLS5	08214014	260	168	94	U	ND
RBT26	WMLS5	08214014	253	160	89	U	1
RBT28	WMLS5	08214014	245	169	96	U	ND
RBT30	WMLS5	08214014	233	130	68	U	ND
RBT31	WMLS6	08214015	375	600	276	F	2
RBT32	WMLS6	08214015	477	782	309	F	3

1 = Male, Female, Unable to determine visually.
ND = Not able to determine age.

Table B2. West Medical Lake Sediment Sample Coordinates and General Description.

Site ID	Latitude	Longitude	General Locations	Water Depth	Sediment Description
WML01	47.56538	-117.70521	Approx. 520' south of outfall	31 Feet	Fine black organic material - H_2S
WML02	47.56656	-117.70465	Approx. ≤ 100' south of outfall	27 Feet	Fine black organic material - H_2S
WML03	47.56709	-117.70494	Approx. ≤ 100' north of outfall	31 Feet	Fine black organic material – H_2S
WML04	47.56811	-117.70602	Approx. 550' north of outfall	32 Feet	Fine black organic material – H_2S (replicate site)
WML05	47.57003	-117.70694	Approx. 1300' north of outfall	33 Feet	Fine black organic material with brown surface
WML06	47.57257	-117.70867	Approx. 2300' north of outfall	33 Feet	Fine black organic material With brown surface
WML07	47.57687	-117.71035	Approx. 4000' north of outfall	30 Feet	Fine black organic material - H_2S

See Figure 3 for station locations.
H_2S = Hydrogen sulfide.

Table B3. PCB Aroclor Results from West Medical Lake Fish Tissue, April 2008 (*u*g/Kg, ww–ppb).

Site ID:	WMLN1	WMLN2	WMLN3	WMLS4	WMLS5	WMLS6	Human Health NTR (Total PCBs)
Sample ID (08):	214010	214011	214012	214013	214014	214015	
Lipids (%):	2.0	2.2	3.5	2.3	1.9	2.8	
PCB - 1016	2.7 U	2.8 U	2.7 U	2.8 U	2.7 U	2.7 U	5.3 *u*g/Kg
PCB - 1221	2.7 U	2.8 U	2.7 U	2.8 U	2.7 U	2.7 U	
PCB - 1232	2.7 U	2.8 U	2.7 U	2.8 U	2.7 U	2.7 U	
PCB - 1242	2.7 U	2.8 U	2.7 U	2.8 U	2.7 U	2.7 U	
PCB - 1248	4.4 UJ	3.3 UJ	5.5 UJ	2.8 U	3.3 UJ	4.4 UJ	
PCB - 1254	**12**	**21 J**	**36 J**	**16 J**	**17 J**	**30 J**	
PCB - 1260	2.7 U	4.4 UJ	11 UJ	3.3 UJ	3.3 UJ	**14 J**	
PCB - 1262	2.7 U	2.8 U	5.5 UJ	2.8 U	2.7 U	8.7 UJ	
PCB - 1268	2.7 U	2.8 U	2.7 U	2.8 U	2.7 U	2.7 U	
Total PCBs	**12**	**21 J**	**36 J**	**16 J**	**17 J**	**44 J**	

U = Not detected at the detection limit shown.
UJ = Not detected at the estimated detection limit shown.
J = The result is an estimate.
Bold = Analyte was detected.

Table B4. Dioxin and Furan Results from West Medical Lake Fish Tissue, April 2008 (ng/Kg, ww; pptr).

Site ID:	TEF[1]	WMLN1		WMLN2		WMLN3		WMLS4		WMLS5		WMLS6	
Sample ID (08):		214010		214011		214012		214013		214014		214015	
Parameter													
Lipids (%)		2.0		2.2		3.5		2.3		1.9		2.8	
Dioxins													
2,3,7,8-TCDD	1	0.03	UJ	0.03	UJ	0.03	UJ	0.03	UJ	0.03	UJ	0.03	UJ
1,2,3,7,8-PeCDD	1	0.033	UJ	0.033	UJ	0.033	UJ	0.033	UJ	0.033	UJ	0.033	UJ
1,2,3,4,7,8-HxCDD	0.1	0.1	UJ	0.1	UJ	0.1	UJ	0.1	UJ	0.1	UJ	0.1	UJ
1,2,3,6,7,8-HxCDD	0.1	0.082	UJ	0.082	UJ	0.082	UJ	0.082	UJ	0.082	UJ	0.082	UJ
1,2,3,7,8,9-HxCDD	0.1	0.064	UJ	0.064	UJ	0.064	UJ	0.064	UJ	0.064	UJ	0.064	UJ
1,2,3,4,6,7,8-HpCDD	0.01	0.085	UJ	0.085	UJ	0.085	UJ	0.085	UJ	0.085	UJ	0.085	UJ
OCDD	0.0003	**0.189**	**J**	**0.329**	**J**	**0.245**	**J**	**0.376**	**J**	**0.671**	**J**	**0.592**	
Furans													
2,3,7,8-TCDF	0.1	**0.678**		**0.503**		**1.06**		**0.364**		**0.866**		**0.708**	
1,2,3,7,8-PeCDF	0.03	**0.086**	**J**	**0.106**	**J**	**0.21**	**J**	**0.096**	**J**	**0.245**	**J**	**0.094**	**J**
2,3,4,7,8-PeCDF	0.03	0.039	UJ	**0.047**	**J**	0.039	UJ	0.039	UJ	0.039	UJ	**0.04**	**J**
1,2,3,4,7,8-HxCDF	0.1	**0.131**	**J**	**0.084**	**J**	0.075	UJ	0.075	UJ	0.075	UJ	**0.116**	**J**
1,2,3,6,7,8-HxCDF	0.1	0.075	UJ	0.075	UJ	0.075	UJ	0.075	UJ	0.075	UJ	0.075	UJ
2,3,4,6,7,8-HxCDF	0.1	**0.085**	**J**	**0.079**	**J**	**0.18**	**J**	0.05	UJ	**0.254**	**J**	0.05	UJ
1,2,3,7,8,9-HxCDF	0.1	0.056	UJ	0.056	UJ	0.056	UJ	0.056	UJ	0.056	UJ	0.056	UJ
1,2,3,4,6,7,8-HpCDF	0.01	0.094	UJ	0.052	UJ	0.052	UJ	0.055	UJ	0.065	UJ	0.052	UJ
1,2,3,4,7,8,9-HpCDF	0.01	**0.128**	**J**	0.085	UJ	0.085	UJ	0.085	UJ	0.085	UJ	0.085	UJ
OCDF	0.0003	**0.284**	**J**	**0.329**	**J**	**0.157**	**J**	**0.179**	**J**	**0.232**	**J**	0.2	UJ
NTR = 0.065 ng/Kg													
TEQ[2]		0.093	J	0.071	J	0.130	J	0.039		0.120	J	0.087	J

[1] = Toxic Equivalent Factor - WHO, 2005.
[2] = Toxic Equivalent Quotient - total toxicity equivalent to 2,3,7,8 TCDD.
UJ = Not detected at the estimated reporting limit shown.
J = Reported result is an estimate.
Bold = Analyte was detected.

Table B5. PCB Results from West Medical Lake Surface Sediment Samples, April 2008 (ug/Kg, dw - parts per billion).

Site ID:	WML01	WML02	WML03	WML04[1]	WML05	WML06	WML07
Date:	4/3/08	4/2/08	4/2/08	4/3/08	4/3/08	4/3/08	4/3/08
Sample ID (08):	144050	144051	144052	144053/7	144054	144055	144056
TOC 70°C (%):	7.3	6.8	6.8	6.3	6.1	7.2	8.0
Fines (%):	66.4 J	75.8	84.4	94.6	95.1	97.2	80.4
PCB - 1016	13 UJ	12 UJ	13 UJ	6.8 U	6.7 U	8.1 U	9.4 U
PCB - 1221	51 UJ	194 UJ	128 UJ	192 UJ	135 UJ	258 UJ	187 UJ
PCB - 1232	51 UJ	73 UJ	51 UJ	6.8 U	54 UJ	8.1 U	9.4 U
PCB - 1242	13 UJ	24 UJ	6.4 U	6.8 U	27 UJ	8.1 U	9.4 U
PCB - 1248	13 UJ	6.1 UJ	6.4 U	6.8 U	13 UJ	8.1 U	9.4 U
PCB - 1254	**11 J**	**17 J**	**16**	**11**	**9.0**	**14**	**19**
PCB - 1260	6.3 UJ	6.1 UJ	6.4 U	6.8 U	6.7 U	8.1 U	9.4 U
PCB - 1262	6.3 UJ	6.1 UJ	6.4 U	6.8 U	6.7 U	8.1 U	9.4 U
PCB - 1268	6.3 UJ	6.1 UJ	6.4 U	6.8 U	6.7 U	8.1 U	9.4 U

1 = The value reported is the mean of a replicate pair.
J = Analyte is positively identified; the result is an estimate.
UJ = Analyte was not detected at the estimated detection limit shown.
U = Analyte was not detected at the detection limit shown.

Table B6. Dioxin and Furan Results from West Medical Lake Sediments, April 2008 (ng/Kg, dw - pptr).

Site ID:	TEF[1]	WML01	WML02	WML03	WML04	WML05	WML06	WML07
Sample ID (08):		144050	144051	144052	144053	144054	144055	144056
Sample Dates:		4/3/08	4/2/08	4/2/08	4/3/08	4/3/08	4/3/08	4/3/08
Parameter								
Dioxins								
2,3,7,8-TCDD	1	**0.60**	**0.56**	**0.76**	**0.37**	**0.29**	**0.35**	**0.32**
1,2,3,7,8-PeCDD	1	**0.71 J**	**0.84**	**0.91**	**0.90**	**0.55 J**	**0.86**	**0.66 J**
1,2,3,4,7,8-HxCDD	0.1	**0.74 J**	**0.48 J**	**0.84**	**0.79**	**0.44 J**	**0.68 J**	**0.45 J**
1,2,3,6,7,8-HxCDD	0.1	**2.5**	**2.0**	**2.6**	**1.9**	**1.6**	**2.1**	**1.9**
1,2,3,7,8,9-HxCDD	0.1	**3.2**	**2.0**	**3.1**	**2.5**	**2.3**	**3.4**	**1.8**
1,2,3,4,6,7,8-HpCDD	0.01	**83**	**74**	**88**	**62**	**45**	**58**	**53**
OCDD	0.0003	**710**	**649**	**745**	**501**	**336**	**420**	**375**
Furans								
2,3,7,8-TCDF	0.1	**10.5**	**8.30**	**9.79**	**7.78**	**5.75**	**10.5**	**10.4**
1,2,3,7,8-PeCDF	0.03	**1.17**	**1.03**	**1.29**	**0.94**	**0.75**	**1.34**	**1.11**
2,3,4,7,8-PeCDF	0.3	**1.48**	**1.05**	**1.42**	**1.21**	**1.00**	**1.35**	**1.24**
1,2,3,4,7,8-HxCDF	0.1	1.47 UJ	1.02 UJ	1.09 UJ	1.01 UJ	0.74 UJ	0.99 UJ	1.05 UJ
1,2,3,6,7,8-HxCDF	0.1	**0.82**	**0.78**	**0.97**	**0.63 J**	**0.5 J**	**0.80 J**	**0.71 J**
2,3,4,6,7,8-HxCDF	0.1	**0.76 J**	**0.91**	**1.06**	**0.79**	**0.41 J**	**0.93**	**0.87**
1,2,3,7,8,9-HxCDF	0.1	**0.13 J**	**0.12 J**	**0.088 J**	**0.098 J**	0.074 UJ	**0.14 J**	**0.075 J**
1,2,3,4,6,7,8-HpCDF	0.01	**13.3**	**13.2**	**15.2**	**10.8**	**7.54**	**7.52**	**7.70**
1,2,3,4,7,8,9-HpCDF	0.01	**0.61 J**	**0.61**	**0.66**	**0.3 J**	**0.40 J**	**0.53 J**	**0.48 J**
OCDF	0.0003	**38.6**	**30.2**	**33.1**	**25.2**	**17.7**	**19.1**	**15.2**
TEQ[2]		4.8	4.3	5.2	4.0	2.9	4.3	3.7
% 2,3,7,8-TCDD		13%	13%	15%	9%	10%	8%	9%
% Dioxins		60%	63%	64%	62%	61%	58%	54%
% Furans		40%	37%	36%	38%	39%	42%	46%

[1] = Toxic Equivalent Factor; WHO, 2005.
[2] = Toxic Equivalent Quotient - total toxicity equivalent to 2,3,7,8-TCDD.
J = The result is an estimate.
UJ = Analyte was not detected at or above the estimated reporting limit shown.
Bold = Analyte was detected.

Table B7. TOC and TSS Results from West Medical Lake Effluent, February, April, July, and October 2008.

Sample ID (08)	Sample ID	Sample Location	Sample Collection[1]		TOC (mg/L)	TSS (mg/L)
			Date	Time		
074000	WMLEFF	Medical Lake WWTP	2/12/08 2/13/08	0820-1500 0820-1510	**3.6**	1 U
184025	WMLEFF	Medical Lake WWTP	4/28/08 4/29/08	0850-1515 0810-1515	**4.3**	1 U
314050	WMLEFF	At old Eastern State Hospital WWTP	7/30/08 7/31/08	0800-1605 0805-1600	**4.5**	1 U
444050	WMLEFF	At old Eastern State Hospital WWTP	10/27/08 10/28/08	0805-1605 0800-1555	NAF	1 U

1 = Effluent samples are composites of AM and PM aliquots collected over two consecutive days.
U = Not detected at the reporting limit shown.
NAF = Not analyzed for. Laboratory instrument malfunctioned - no result.

Table B8. PCB Congener Concentrations in Medical Lake WWTP Effluent, February, April, July, and October 2008 (pg/L, parts per quadrillion).

	Sample Dates:	2/12-13/08	4/28-29/08	7/30-31/08	10/27-28/08
	Sample ID (08):	074000	184025	314050/1[1]	444050/1[1]
PCB Homolog Groups	Mono-	44.5 UJ	71 UJ	41.3 UJ	36.9 UJ
	Di-	**68.5**	**39.7**	**27.4 J**	10 U
	Tri-	**46.6 J**	**35.8 J**	**75.8**	**22.1**
	Tetra-	**16.1**	**19.8**	**9.7 J**	12.7 UJ
	Penta-	10 U	31.6 UJ	**28.2 J**	**11.5 J**
	Hexa-	10 U	15.2 UJ	**11.8 J**	**13.0 J**
	Hepta-	10 U	10 U	10 U	10 U
	Octa-	10 U	10 U	10 U	10 U
	Nona-	10 U	10 U	10 U	10 U
	Deca-	10 U	10 U	10 U	10 U
	Total PCBs	**131 J**	**95.3 J**	**153 J**	**46.6 J**

1 = Results are a mean of a replicate pair. Where one sample analyte was detected and the companion result was not detected, one-half of detection was used in the mean.
Bold = Analyte was detected.
UJ = Not detected at the estimated detection limit shown.
J = The result is an estimate.
U = Not detected at the detection limit shown.

Table B9. Dioxin and Furan Results for the Medical Lake WWTP Effluent, February, April, July, and October 2008 (pg/L, parts per quadrillion).

Sample Date:	TEF[2]	2/13/08		4/29/08		7/31/08		10/28/08	
Sample ID (08):		74000		184025		314050/1[1]		444050/1[1]	
Parameter									
Dioxins									
2,3,7,8-TCDD	1	0.5	UJ	**0.56**	**J**	0.5	UJ	0.5	UJ
1,2,3,7,8-PeCDD	1	1	UJ	1	UJ	1	UJ	1	UJ
1,2,3,4,7,8-HxCDD	0.1	1	UJ	1	UJ	1	UJ	1	UJ
1,2,3,6,7,8-HxCDD	0.1	1	UJ	1	UJ	1	UJ	1	UJ
1,2,3,7,8,9-HxCDD	0.1	1	UJ	1	UJ	1	UJ	1	UJ
1,2,3,4,6,7,8-HpCDD	0.01	1	UJ	1	UJ	1	UJ	1	UJ
OCDD	0.0003	2	UJ	**3.03**	**J**	2	UJ	2	UJ
Furans									
2,3,7,8-TCDF	0.1	0.5	UJ	0.5	UJ	1.17	UJ	1.39	UJ
1,2,3,7,8-PeCDF	0.03	1	UJ	1	UJ	1	UJ	1	UJ
2,3,4,7,8-PeCDF	0.3	1	UJ	1	UJ	1	UJ	1	UJ
1,2,3,4,7,8-HxCDF	0.1	1	UJ	1	UJ	1	UJ	1	UJ
1,2,3,6,7,8-HxCDF	0.1	1	UJ	1	UJ	1	UJ	1	UJ
2,3,4,6,7,8-HxCDF	0.1	1	UJ	1	UJ	1	UJ	1	UJ
1,2,3,7,8,9-HxCDF	0.1	1	UJ	1	UJ	1	UJ	1	UJ
1,2,3,4,6,7,8-HpCDF	0.01	1	UJ	1	UJ	1	UJ	1	UJ
1,2,3,4,7,8,9-HpCDF	0.01	1	UJ	1	UJ	1	UJ	1	UJ
OCDF	0.0003	2	UJ	2	UJ	2	UJ	2	UJ
TEQ[3]		2	UJ	**0.56**	**J**	2	UJ	2	UJ

[1] = Results are for a replicate pair. Where detection limits are different, the higher is shown.
[2] = Toxic Equivalent Factor; WHO, 2005 (Van de Berg et al.).
[3] = Toxic Equivalent Quotient - total toxicity equivalent to 2,3,7,8-TCDD.
UJ = Analyte was not detected at or above the estimated reporting limit shown.
J = The result is an estimate.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
WATER

JUN 25 2004

Ms. Maxine I. Lipeles, J.D.
Director, Interdisciplinary Environmental Clinic
Washington University in St. Louis
1 Brookings Drive #1120
St. Louis, MO 63130

Dear Ms. Lipeles:

Thank you for your letter of February 25, 2003, to Administrator Whitman transmitting a petition on behalf of the Ozark Chapter of the Sierra Club requesting that the U.S. Environmental Protection Agency (EPA) set consistent and adequate water quality standards for defined portions of the Mississippi and Missouri rivers. EPA has carefully considered your petition and our formal response is enclosed.

In summary, EPA agrees with the Sierra Club that the Mississippi and Missouri Rivers are valuable resources that must be protected. After evaluating the currently approved water quality standards applicable to the petition area waters, the existing scientific knowledge for each pollutant at issue, and whether the affected states are working to establish or revise water quality standards in a manner that would address potential concerns, EPA is denying the Sierra Club's specific request but committing to further action.

In our discussions with you and the Sierra Club, you specified that two of your highest priority issues are numeric criteria for nutrients and bacteria. You also indicated that if federal promulgation of numeric nutrient criteria was not an option, you would like to see more federal leadership on nutrient issues in the petition area. In response to the petitioners' request to promulgate numeric nutrient criteria, we do not believe it is appropriate to promulgate numeric criteria for these specific waters until the science and the development of numeric nutrient criteria in the big rivers are better understood. However, in response to your request for more federal leadership, in addition to the ongoing work to address hypoxia in the Gulf of Mexico, EPA is committing to convene a multi-day national workshop to bring together states and others to discuss the development and adoption of appropriate ambient water quality criteria for nutrients for the Mississippi and Missouri Rivers to protect the rivers as well as the Gulf of Mexico. Following the workshop, EPA will publish a report that will summarize the results of the workshop, identify next steps, and establish a roadmap for how EPA would work with its partners to address nutrients in the Mississippi and Missouri Rivers. EPA has identified the necessary funds and will begin planning the workshop immediately with the intent to hold the workshop in 2005. EPA hopes that the Sierra Club and other stakeholders will actively participate in this effort to help ensure success. In the interim, EPA will continue to assist the states and invest additional resources in the development and adoption of nutrient criteria for the rivers' tributaries, with the expectation that state adoption and implementation of nutrient criteria for tributaries of the Mississippi and Missouri Rivers will lead to an overall reduction of nutrient loadings entering the petition area and thus flowing to the Gulf of Mexico.

With regard to the petitioners' request to promulgate bacteria criteria in the petition area, we are pleased to inform you that both Illinois and Missouri have sent EPA formal letters committing to adopt *E. coli* criteria for the petition area (among other waters) within their states. Missouri has committed to adopt *E.coli* criteria (as well as appropriate recreation uses) by July of 2005. Illinois has committed to initiate its rulemaking process to adopt *E. coli* criteria by September 30, 2004. The remaining six states have either adopted *E. coli* criteria or have proposed *E. coli* criteria in their state rulemaking process and are moving forward to adopt it into state regulation. If any state does not follow through on its commitment, EPA will, if necessary, promulgate water quality standards for the petition area within these states.

The Agency expects states to protect their waters consistent with the requirements of the Clean Water Act and the federal regulations. While EPA is not promulgating water quality standards for the petition area in response to the petition at this time, EPA is committed to continue to work with states and others to ensure these valuable waters are adequately protected.

We understand the Sierra Club's concern regarding the consistency, adequacy, and effective monitoring of water quality standards for the Mississippi and Missouri Rivers. I want to assure you EPA carefully considered the petition and the additional information you provided in our decision making process. If you would like to discuss your concerns further, please feel free to contact me at (202) 564-5700 or Geoffrey Grubbs, Director of the Office of Science and Technology at (202) 566-0430.

Sincerely,

[Signed by Ben Grumbles, June 25, 2004]

Benjamin H. Grumbles
Acting Assistant Administrator

Enclosure

cc. J. I. Palmer, Jr, Regional Administrator, Region 4
Bharat Mathur, Acting Regional Administrator, Region 5
Richard Greene, Regional Administrator, Region 6
James B. Gulliford, Regional Administrator, Region 7

DECISION ON PETITION FOR RULEMAKING TO PUBLISH WATER QUALITY STANDARDS FOR THE MISSISSIPPI AND MISSOURI RIVERS WITHIN ARKANSAS, ILLINOIS, IOWA, KANSAS, KENTUCKY, MISSOURI, NEBRASKA AND TENNESSEE

On February 26, 2003, the Ozark Chapter of the Sierra Club (hereafter Sierra Club or petitioner) submitted a petition to the United States Environmental Protection Agency (hereafter "EPA" or Agency) requesting that EPA publish water quality standards for the Mississippi and Missouri Rivers within the petition area. As described below, EPA has given careful consideration to the issues raised in the petition and its request but is HEREBY DENYING the petition for the reasons set forth below.

Petition for Rulemaking

On February 26, 2003, the Ozark Chapter of the Sierra Club submitted a petition requesting that EPA set consistent and adequate water quality standards for defined portions of the Mississippi and Missouri Rivers ("petition area"). The petition area includes portions of the Mississippi and Missouri Rivers in Arkansas, Illinois, Iowa, Kansas, Kentucky, Missouri, Nebraska, and Tennessee ("the petition states"). The Sierra Club submitted this petition pursuant to Paragraph 9 in the Settlement Agreement in American Canoe Ass'n v. Browner, 98-1195-CV-W and 98-482-CV-W (W.D. Mo.) (Effective date 2-27-01).

The petitioner summarizes its request as follows:

> Pursuant to the Settlement Agreement[1], the Ozark Chapter requests that, within one year of receipt of this petition, the EPA publish water quality standards for the Mississippi and Missouri Rivers within the petition area states. Such standards should be:
>
> 1) Consistent among the states on each river, such that no state impairs the ability of any other affected state (whether across-stream or downstream) to achieve its water quality standards; and
> 2) Adequate:
>   a) Including numeric criteria for chlordane, atrazine, polychlorinated biphenyls, *E. coli*, enterococci, conventionals (including dissolved oxygen and ammonia), nutrients, sediments, and an index of biological integrity for the aquatic community ("the petition pollutants"), among other criteria; and
>   b) Reflecting criteria sufficient to achieve and maintain fishable/swimmable water quality criteria.
> *3)* In addition, such standards should include monitoring requirements sufficient to support a uniform, statistically based method for determining whether the rivers are meeting their water quality standards. Petition at 2 – 3.

[1] Settlement Agreement. American Canoe Ass'n v. Browner, 98-1195-CV-W and 98-482-CV-W (W.D.M.o). Effective date 2-27-01. The Settlement Agreement provides that EPA will "grant or deny" the petition within a year of its receipt. On February 26, 2004, the parties to the settlement agreed to extend the date by which EPA would respond to the petition to June 25, 2004.

Statutory and Regulatory Background

The Clean Water Act (CWA) establishes a comprehensive program "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." CWA section 101(a). The interim goal of the CWA is to attain water quality that provides for the protection and propagation of fish, shellfish, and wildlife. CWA section 101(a)(2).

The CWA section 303 requires states to adopt (subject to federal approval) water quality standards. The principle components of states' water quality standards are: (a) designated uses for waters, such as water supply, recreation, fish propagation, agriculture, and navigation; (b) water quality criteria, which define the amounts of pollutants the waters may contain without impairing their designated uses; and (c) antidegradation requirements, which protect existing uses and otherwise limit degradation of waters. CWA section 303(c)(2)(A) and 303(c)(2)(B), and 40 C.F.R. §§131.3(b), 131.3(f), 131.3(i), 131.6, 131.10-.11 (uses and criteria); and 40 C.F.R. §131.12 (antidegradation).

Designated Uses

Pursuant to CWA section 303(c)(2)(A) and 40 C.F.R. §131.10(a), states must designate appropriate water uses to be achieved and protected taking into consideration the use and value of water for public water supplies, protection and propagation of fish, shellfish, and wildlife, recreation in and on the water, agricultural, industrial, and other purposes including navigation. Where existing water quality standards specify designated uses less than those that are presently being attained, the state shall revise its standards to reflect the uses actually being attained. 40 C.F.R. §131.10(i). A state must conduct a use attainability analysis (UAA) where a state designates or has designated uses that do not include uses specified in section 101(a)(2) (sometimes referred to as "fishable/swimmable"), or where the state wishes to remove designated uses specified in section 101(a)(2), or to adopt subcategories of uses specified in section 101(a)(2) which require less stringent criteria. 40 C.F.R. §131.10(j).

Water Quality Criteria

The CWA section 304(a)(1) provides that EPA shall develop (and from time to time thereafter, revise) recommended water quality criteria based on current data and scientific judgment regarding the relationship between pollutant concentrations and environmental and human health effects. EPA's recommended section 304(a) criteria serve as guidance for states to use in deriving criteria to protect states' adopted designated uses.

EPA currently derives its section 304(a) water quality criteria for the protection of aquatic life using EPA's *Guidelines for the Derivation of Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses* ("Guidelines") (Stephan et al. 1986. NTIS: PB85-227049). The Guidelines provide that each criterion is derived from the evaluation of toxicological data from a representative universe of species, allows for the inclusion of site-specific considerations, and results in a chemical concentration expected to be protective of aquatic life and their uses.

EPA currently derives its section 304(a) water quality criteria for the protection of human health using the *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000)* ("Methodology") (EPA-822-B-00-004, www.epa.gov/waterscience/humanhealth/method). The Methodology details the necessary components of the risk assessment: hazard (cancer and non-cancer effects), exposure (from drinking water and fish consumption rates), and bioaccumulation (from measured or calculated bioaccumulation factors). The exposure component of criteria is based on consumption of contaminated aquatic organisms and drinking water. Many of the hazard identification and dose response assessments can be found in EPA's Integrated Risk Information System (IRIS)[2], a database that summarizes available toxicity data and contains EPA's assessment of the data. EPA establishes criteria at a recommended risk level for carcinogens; however, selection of a specific risk level is a risk management decision and EPA believes adoption of either a 10^{-6} or a 10^{-5} risk level represents an acceptable range of discretion for states and tribes[3].

The scientific efforts that lead to the publication of a final ambient water quality criterion for protection of either aquatic life or human health typically need 18 months or more to complete. EPA follows the procedures described in EPA's *Guidelines for the Derivation of Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses* and the *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000)*, as well as Agency policy and procedures governing the development of scientific data and documents. This process includes an extensive search of peer reviewed literature, data quality evaluation, criterion and supporting documentation derivation, public scientific input, and peer review. Both the derivation process and the public and peer participation are critical to ensuring that the final section 304(a) criteria meet the clarity, transparency, and scientific rigor standards of the Agency. These steps ensure that the final criteria are scientifically defensible and that risk management decisions based on the criteria are legally defensible.

Ultimately, water quality criteria provide a basis for controlling discharges or releases of pollutants into surface waters. In establishing criteria, EPA's regulations require states to adopt water quality criteria to protect designated uses by adopting EPA's section 304(a) criteria recommendations, modifying EPA's section 304(a) criteria recommendation to reflect site-specific conditions, or deriving and adopting criteria based on other scientifically defensible methods. 40 C.F.R.§131.11. In addition, states may establish narrative criteria where numeric criteria cannot be established or to supplement numeric criteria.

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[2] U.S. Environmental Protection Agency. Integrated Risk Information System. < http://www.epa.gov/iriswebp/iris/index.html>

[3] U.S. Environmental Protection Agency. *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000).* Office of Water, Washington D.C., EPA-822-B-00-004. October 2000.

Under the regulations[4], narrative criteria have the same force and effect as numeric criteria. The National Pollutant Discharge Elimination System (NPDES) regulations require that the permitting authority establish water quality-based effluent limits for any parameters in the discharge of a point source that the permitting authority determines are or may be discharged at a level which will cause, have reasonable potential to cause, or contribute to an excursion above any applicable state water quality standards, including narrative criteria. 40 C.F.R. §122.44(d)(1)(i). EPA regulations specify three options for deriving a numeric effluent limitation for a particular parameter designed to implement a narrative criterion: (1) use a calculated numeric water quality criterion; (2) use EPA's section 304(a) water quality criteria on a case-by-case basis, supplemented by other relevant information; or (3) use an indicator parameter (see 40 C.F.R. §122.44(d)(1)(vi)). CWA section 303(d) requires states to identify water quality limited segments (i.e. impaired waters) that do not meet applicable water quality standards. For those water quality limited segments identified under 40 C.F.R. § 130.7, the CWA and EPA's regulations require states to develop Total Maximum Daily Loads (TMDLs) which specify the maximum pollution loads the water body can assimilate and still meet water quality standards. TMDLs also allocate these loads among the various pollution sources. For the purposes of CWA section 303(d), "applicable water quality standards refers to water quality standards established under CWA section 303 "…including numeric criteria, narrative criteria, [and] water body uses…" 40 C.F.R. §130.7(b)(3).

Protection of Downstream Uses

The federal regulations state, "In designating uses of a water body and the appropriate criteria for those uses, the State shall take into consideration the water quality standards of downstream waters and shall ensure that its water quality standards provide for the attainment and maintenance of the water quality standards of downstream waters." 40 C.F.R. §131.10(b). The regulations do not compel states to adopt the same criteria and uses, nor do they suggest that this is the only way a state can meet these requirements. The water quality program is structured to provide states with flexibility to determine the best way to meet their obligations under § 131.10(b).

Under the NPDES permitting regulations, no permit may be issued "when the imposition of conditions cannot ensure compliance with applicable water quality requirements of all affected States[.]" 40 C.F.R. §122.4(d). To obtain approval of a state NPDES program, the CWA requires the state to have the authority to notify other affected states of applications for permits and provide an opportunity for a hearing. CWA section 402(b)(3). Further, the state must allow any state whose waters may be affected by the discharge to submit recommendations. If the permitting state rejects the recommendations, it must notify the affected state and EPA Administrator. CWA section 402(b)(5). Where EPA determines the permitting state rejected the recommendations for inadequate reasons, EPA may exercise its discretionary authority to object to the permit. If the objection is not resolved, EPA may issue a federal permit. 40 C.F.R. §123.44 (c)(2).

[4] 40 C.F.R. §122 and 40 C.F.R. §130

EPA's Authority and Role

Whenever a state adopts new or revised water quality standards, the state is required under the CWA section 303(c) to submit such standards to EPA for review and approval or disapproval. EPA reviews and approves or disapproves the water quality standards based on whether the standards meet the requirements of the CWA and federal regulations as discussed above.

If EPA determines that a new or revised water quality standard submitted for its review is consistent with the CWA's requirements, the standards "shall thereafter be the water quality standard for the applicable waters" of the state. If EPA determines that a new or revised water quality standard is inconsistent with the CWA's requirements, EPA is to notify the state of the relevant shortcomings (i.e. EPA will "disapprove" the state's water quality standards) and specify the changes needed to meet the CWA's requirements. The state then has ninety days to adopt the changes specified. CWA Section 303(c)(3). If such changes are not adopted, EPA is then required to promulgate a federal standard. In doing so, EPA shall "promptly prepare and publish proposed regulations setting forth a revised or new water quality standard for the navigable waters involved" and promulgate ninety days thereafter if the state still has not adopted water quality standards in accordance with the CWA. CWA Section 303(c)(4).

In addition to EPA's authority to review and approve new and revised water quality standards, EPA also has a separate, discretionary authority to promulgate federal water quality standards for a state if the Administrator determines that new or revised water quality standards are necessary to meet the requirements of the CWA. CWA Section 303(c)(4)(B), 40 C.F.R. §§131.5(b), 131.22(b). In its petition to EPA, the Sierra Club asks that the EPA Administrator exercise his discretionary authority under the Clean Water Act to correct the perceived deficiencies identified by the Sierra Club in its petition. Therefore, in deciding if promulgation of water quality standards is "necessary to meet the requirements of the CWA," EPA has evaluated whether the minimum requirements of the Act and the federal regulations (i.e., designated uses consistent with sections 101(a)(2) and 303(c)(2)(A) and criteria protective of those uses), are satisfied by the existing state water quality standards. Below, each of the specific issues raised by the Sierra Club are reviewed against this standard.

The structure of the Water Quality Standards program, as described, reflects Congress' intent to "recognize, preserve, and protect the primary responsibilities and rights of states to prevent, reduce, and eliminate pollution [and] to plan the development and use (including restoration, preservation and enhancement) of … water resources[.]" CWA Section 101(b). Accordingly, the CWA confers to the states primary authority for setting water quality standards. EPA's role is largely one of oversight, in which it reviews a state's new or revised water quality standards as they are adopted by the states and submitted to EPA. CWA Section 303(c). EPA exercises its discretionary authority under CWA section 303(c)(4)(B) only when the Administrator has determined that the existing state water quality standards are insufficient to meet the requirements of the CWA.

<u>EPA's approach to evaluating the petition, state standards, and the need for Federally promulgated water quality standards</u>

In determining how to respond to the petition, EPA considered the following:

(1) What are the currently approved water quality standards that apply to the petition area and what are the apparent differences in state water quality standards that the petitioner identifies?

EPA reviewed the petition and the addenda in the petition, which contain multiple tables comparing uses and criteria within the petition area. After reviewing this information, EPA conducted its own independent analysis of the currently approved state water quality standards.[5, 6]

(2) Are the water quality standards of the petition states inconsistent with the CWA? Do any differences in water quality standards among the petition states indicate the standards are inconsistent with the CWA?

As discussed earlier, the federal regulations do not compel states to adopt the same criteria and uses to meet the requirements of the Act. Therefore, differing water quality standards do not necessarily indicate that the water quality standards are inconsistent with the CWA. Where differences in water quality standards were confirmed in EPA's analysis, EPA examined whether the various state water quality standards nonetheless provided protection for the petition area waters. Such protection could be afforded in a number of ways. EPA looked to see if a state applies ambient water quality criteria, either as part of general standards that apply to all waters or criteria to protect another designated use that would protect the designated uses applicable to the petition area. EPA looked to see if a state might have implementation procedures outside of EPA approved water quality standards (e.g., procedures to derive numeric criteria) that would further describe how the state implements its water quality standards and whether this information would resolve any apparent inconsistencies/inadequacies. EPA also reexamined the state water quality standards to determine why the differences might exist. To do so, EPA compared state water quality criteria to EPA's previous section 304(a) criteria recommendations and looked at the assumptions/policy decisions that states used to determine if the criteria were derived using scientifically defensible methods.

(3) Are the differences in water quality standards a basis for environmental concern?

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[5] See Attachment A
[6] See Attachment B

Where EPA confirmed states have different designated uses and/or criteria for the petition area, EPA evaluated the degree of environmental concern linked to those specific differences. EPA evaluated the petition data to determine whether the petitioner identified any specific information to indicate where the differences were causing an environmental problem of concern. EPA then reviewed states' section 303(d) impaired waters lists for 2002 to see whether the states themselves identified segments within the petition area to be impaired by the petition pollutants. If a state identified the pollutant on the section 303(d) list, EPA then investigated whether any documented evidence exists to show that water from an upstream state or across stream state was the leading cause of the impairment even if that water body was meeting the upstream or across stream states' water quality standards.

(4) Is the current level of scientific knowledge sufficient to determine the criteria appropriate to adequately protect designated uses?

EPA investigated the current status of scientific knowledge for each pollutant identified by the petitioner. EPA first identified its most current section 304(a) criteria recommendation. EPA then considered where it is in the process to either revise its section 304(a) criteria recommendations or to derive a section 304(a) criteria recommendation for pollutants where one does not exist. EPA also evaluated the scientific understanding of these pollutants to determine whether the science is sufficient at this time to support federal or state development of numeric ambient water quality criteria for the petition area.

(5) Are the states working to revise their water quality standards in a way that would address the concerns of this petition?

Development and implementation of water quality standards to protect state waters are primarily the state's responsibilities. CWA section 101(b). EPA identified the instances where adjacent states adopted different ambient water quality criteria for pollutants that EPA has provided section 304(a) criteria recommendations and determined if these differences have the potential to cause adverse effects. In these cases, EPA evaluated whether the states are making a good faith effort to revise their water quality standards to address these concerns and incorporate the latest scientific knowledge.

Issues Identified by Petitioner and EPA's Response

1) Designated Uses

Petitioner's Position - The Sierra Club claims that while variations in designated uses are acceptable in some circumstances, states have designated uses throughout the petition area that vary inappropriately. The petitioner maintains that as a result of these inconsistencies, "when downstream states designate these interstate rivers for uses such as drinking water, fishing, and contact recreation, but upstream states do not protect for those uses, downstream states may be unable to achieve their water quality standards." Petition at 12. In the petition, the Sierra Club specifically identifies that, unlike their surrounding states, Kentucky does not designate the Mississippi River for drinking water, Iowa does not designate the Mississippi or Missouri Rivers for a fishing use, and Missouri does not designate the Mississippi or Missouri Rivers for primary contact recreation. The Sierra Club also claims that Iowa designates one portion of the Missouri River for non-contact recreation whereas stretches above and below that portion of the river are classified for primary contact recreation. Petition at 10 – 11. The petitioner requests that EPA use its authority under the CWA section 303(c)(4) to promulgate water quality standards applicable to the Mississippi and Missouri Rivers in the eight state region around the rivers' confluence. Such standards should be consistent among the states on each river, such that no state impairs the ability of any other affected state (whether across-stream or downstream) to achieve its water quality standards. Petition at 1 and 3.

EPA Response – For the reasons provided below, EPA concludes that it is unnecessary to federally promulgate, at this time, any designated uses for the petition area to meet the requirements of the CWA section 303(c) or the federal water quality standards regulations at 40 C.F.R. Part 131.

a) Aquatic life Use

In the petition, the Sierra Club did not discuss any specific concerns regarding the designated aquatic life uses within the petition area. However, tables contained in the petition's addenda (see addenda 6 and 7), showed that some petition states designate aquatic life uses for the petition area differently from their neighboring states.

The Sierra Club's addenda show that all states within the petition area designate an aquatic life use to these waters but label the uses differently. To understand the significance of these differences, EPA evaluated the currently approved state water quality standards to determine whether the petition states' water quality standards are inconsistent with the CWA and federal regulations at 40 C.F.R. Part 131 such that a federal promulgation of aquatic life uses is necessary. EPA found that while the specific terms used by each state may differ (e.g., Significant Resource Warm Water (IA), Warm Water Aquatic Habitat (KY), Perennial Delta Fishery (AR))[7], each state designates uses to protect aquatic life consistent with the CWA and federal regulations. Based on this information, EPA determined that each state designates a use to provide for the protection and propagation of fish, shellfish, and wildlife. Therefore, EPA does not believe it is necessary to federally promulgate, at this time, aquatic life uses for the petition area to meet the requirements of the CWA under CWA section 303(c)(4)(B).

b) Drinking water supply

The Sierra Club points out in the designated use section of the petition that Kentucky does not designate the Mississippi River for drinking water uses whereas surrounding states have

[7] See Attachment B

made such a designation. Petition at 10. Addendum 6 of the petition also indicates that Tennessee does not designate a drinking water use for the segment of Mississippi River from the upstream end of the Loosahatchie Bar to the Mississippi/Tennessee state line. The petitioner did not provide any specific evidence of adverse impacts on drinking water uses resulting from these differences. EPA evaluated the information contained in the petition and the currently approved state water quality standards to determine if the petition states' water quality standards are inconsistent with the CWA and federal regulations at 40 C.F.R. Part 131 such that a federal promulgation of drinking water uses is necessary. To assess the potential for human health impacts, EPA also identified the drinking water intake locations and assessed whether there is any evidence that the drinking water use at these intakes is impaired as a result of different water quality standards within the petition area.

EPA found that where segments of the Mississippi and Missouri Rivers in the petition area are used for drinking water (i.e., drinking water intakes exist) states have designated those segments for a drinking water use. Kentucky does not designate its portion of the Mississippi River for drinking water supply because the state does not use the Mississippi River as a source of drinking water. Tennessee does not designate the segment of the Mississippi River from the upstream end of Loosahatchie Bar to the Mississippi/Tennessee state line as drinking water because they do not use this segment for drinking water. This Tennessee segment, however, while identified in addendum 6, is not within this petition area as defined in the petition. Therefore, EPA will not address this segment further in its response.

Since Kentucky does not designate the Mississippi River for a drinking water source, EPA evaluated whether an across stream or downstream state's drinking water uses are impaired by Kentucky's lack of designated drinking water use. While it is true that Missouri and Tennessee designate the Mississippi River located within the petition area for a drinking water use, EPA confirmed that Missouri does not have any drinking water intakes along the Mississippi River located across from Kentucky (Cape Girardeau south to Kentucky/Tennessee border) and Tennessee (which is downstream of Kentucky) does not have any drinking water intakes at all along the Mississippi River. In addition, neither Missouri nor Tennessee lists the drinking water uses on the Mississippi River within their jurisdiction as impaired. Therefore, EPA concludes that Kentucky's lack of a drinking water use is not preventing a downstream or across stream state from attaining and maintaining a drinking water use since there are no drinking water intakes or drinking water use impairments downstream or across stream from Kentucky. Therefore, Kentucky's lack of a public water supply designated use is consistent with the CWA and federal regulations at 40 C.F.R. §131.10(b). EPA concludes it is unnecessary to federally promulgate, at this time, drinking water uses for Kentucky within the petition area to meet the requirements of the CWA under CWA section 303(c)(4)(B).

c) Fish Consumption

The Sierra Club asserts that Iowa does not designate the Mississippi and Missouri Rivers for fish consumption although its waters are adjacent to Illinois, which the Sierra Club indicates has designated a fish consumption use. Petition at 10 – 11. Addenda 6 and 7, however, show that Illinois does not designate the Mississippi River for fishing. EPA evaluated this information and the currently approved state water quality standards to determine if the petition states' water quality standards are inconsistent with the CWA and federal regulations at 40 C.F.R. Part 131 such that a federal promulgation of fish consumption uses is necessary.[8] EPA first looked to see which states explicitly designate fish consumption as a use applicable to the petition area. For those states that do not, EPA evaluated the states' water quality standards to determine whether the criteria applicable to the petition area protect fish consumption uses in the petition area.

Missouri's aquatic life use is labeled Warm Water and Human Health Fish Consumption. Kansas designates the Missouri River for Food Procurement which is defined as "the use of surface waters other than stream segments for obtaining edible forms of aquatic or semiaquatic life for human consumption"[9], thus protecting human health for fish consumption. The remaining six states (Kentucky, Tennessee, Iowa, Nebraska, Illinois and Arkansas) do not explicitly designate fish consumption as a use within the petition area; however, all six of these states apply ambient water quality criteria to the petition area applicable to all surface waters or to protect another designated use that were derived to protect humans from possible risks posed by fish consumption. For example, Kentucky's minimum criteria applicable to all surface waters includes water quality criteria for the protection of human health from the consumption of fish tissue (See 401 KAR 5:031 Surface Water Standards, Section 2 Minimum Criteria Applicable to Surface Waters, Table 1 Water Quality Criteria for the Protection of Human Health from the Consumption of Fish Tissue).[10]

With regard to the Sierra Club's specific concern that Iowa lacks a fish consumption use, Iowa's Class B (WW) or Warm Water Aquatic Life use, which applies to both the Mississippi and Missouri Rivers within the petition area, includes a narrative provision (see Iowa State Standards at 567 IAC 61.3(1)(b)(4)) to prohibit the contamination of fish tissue which would present a hazard to human health as well as numeric water quality criteria for specific pollutants intended to protect human health from possible risks posed by fish consumption (See Iowa State Standards, 567 IAC 61.3(3) Table 1).

EPA concludes that while all the petition states do not specifically designate the petition area for fish consumption, all petition states apply human health criteria to protect humans from possible risks posed by fish consumption and therefore effectively protect fish consumption uses consistent with the CWA and federal regulations at 40 C.F.R. Part 131. Therefore, it is unnecessary for EPA to federally promulgate, at this time, a fish consumption use for any state within the petition area to meet the requirements of the CWA under CWA section 303(c)(4)(B).

d) Recreation

The Sierra Club points out that Missouri designates the Mississippi and Missouri Rivers for secondary contact recreation use while surrounding states designate the waters for primary contact recreation use. The petition further states that one portion of the Missouri River in Iowa's jurisdiction is designated for non-contact recreation instead of primary contact recreation

[8] See Attachment B
[9] See Attachment A
[10] See Attachment A

uses. Petition at 10 – 11. Addenda 6 and 7 reiterate this information. EPA evaluated this information and the currently approved state water quality standards to determine if the petition states' water quality standards are inconsistent with the CWA and federal regulations at 40 C.F.R. Part 131 such that a federal promulgation of recreation uses is necessary.[11] EPA first reviewed each state's water quality standards to determine what recreation uses and associated criteria apply to protect these uses. Where EPA found a primary contact recreation use and/or the associated ambient water quality criteria absent, EPA discussed its findings with the state to determine whether the state intended to revise its water quality standards in the near future, and if that revision would resolve the issue identified in this petition.

EPA's analysis shows that Illinois, Kentucky, Tennessee, Arkansas, Nebraska, Kansas, and Iowa have all adopted primary contact recreation uses and the water quality criteria to protect a primary contact recreation use for all segments of the Mississippi and/or Missouri Rivers within the petition area. While the petitioner identifies Iowa as not applying a primary contact use to one segment along the Missouri River, EPA's analysis showed that Iowa has designated all portions of the Missouri River within the petition area for primary contact recreation. The stretch of the Missouri River within Iowa's jurisdiction flows from the confluence with the Big Sioux River to the Iowa/Missouri state line. Iowa's water quality standards specifically state that the Missouri River from the Iowa/Missouri state line to the confluence with the Big Sioux River is designated for Class A (waters "to be protected for primary contact recreation"), among other uses (See Iowa State Standards, 567 IAC 61.3(5)(e)).

On October 14, 2003, the Missouri Coalition for the Environment filed a lawsuit against EPA alleging that EPA has a duty to promulgate water quality standards for Missouri. One of the issues raised in the lawsuit is Missouri's lack of primary contact recreation uses. The state of Missouri has provided EPA a letter committing to adopt a primary contact use (labeled "whole body contact" by the state of Missouri) for the waters within the petition area (among others in the state). Missouri has committed to completing its rulemaking process to adopt such uses by July of 2005.

To summarize, seven of the eight petition states have adopted primary contact recreation uses for the petition area consistent with the CWA and federal regulations at 40 C.F.R. Part 131 and Missouri has initiated a rulemaking process to adopt primary contact uses for the petition area by January 2005, for the petition area. For this reason, EPA concludes that it is unnecessary for EPA to federally promulgate, at this time, a primary contact use for Missouri or Iowa within the petition area to meet the requirements of the CWA under CWA section 303(c)(4)(B) in response to this petition.

e) ***Agriculture, Aesthetics, Irrigation, Livestock & Wildlife watering, Navigation, Industrial uses***

In the petition, the Sierra Club did not identify any specific instances where states designated agriculture, aesthetic, irrigation, livestock and watering, navigation or industrial uses to the petition area differently. However, tables contained in the petition's

[11] See Attachment B

addenda (see addenda 6 and 7), showed some differences in how petition states designate these uses for the petition area.

The addenda show differences among the states' designations for agriculture, aesthetics, irrigation, livestock and wildlife watering, navigation, and industrial uses. For example, while Iowa, Illinois, Arkansas and Tennessee designate the Mississippi River within the petition area for agricultural uses, Missouri does not. To understand the significance of these differences, EPA evaluated the currently approved state water quality standards to determine whether the petition states' water quality standards are inconsistent with the CWA and federal regulations at 40 C.F.R. Part 131 such that a federal promulgation of any of these uses is necessary. Based on a review of the petition states' approved water quality standards[12], the criteria adopted to protect aquatic life uses are more stringent than the criteria that are or would be applied to protect agriculture, aesthetics, irrigation, livestock and wildlife watering, navigation, or industrial uses within the petition area. Therefore, EPA concludes that the most stringent criteria that the states apply to the petition area to protect aquatic life will also protect agriculture, aesthetics, irrigation, livestock and wildlife watering, navigation and industrial uses wherever they have been designated in the petition area. Accordingly, it is not necessary for EPA to promulgate, at this time, any of these uses for the petition area to meet the requirements of the CWA under CWA section 303(c)(4)(B).

2) Water Quality Criteria

Petitioner's Position – In addition to the concerns regarding designated uses, the Sierra Club asserts that the problems in the petition area are compounded by states applying different criteria or no criteria to protect designated uses even in the situations where the underlying designated uses are equivalent. The Sierra Club specifically identifies the following pollutants at issue: chlordane, atrazine, polychlorinated biphenyls, *E. coli*, enterococci, dissolved oxygen, ammonia, nutrients, and sediments. They also identify the need for an index of biological integrity for the aquatic community. Petition at 3. The petitioner requests that EPA exercise its authority under section 303(c)(4) of the CWA to promulgate water quality standards applicable to the Mississippi and Missouri Rivers in an eight state region around the rivers' confluence. EPA should set standards that are adequate to achieve the CWA's fishable/swimmable requirements.

EPA's Response – EPA evaluated the currently approved water quality criteria within the petition area for chlordane, atrazine, polychlorinated biphenyls, *E. coli*, enterococci, dissolved oxygen, ammonia, nutrients, sediments, and an index of biological integrity for the aquatic community to determine if the criteria are consistent with the requirements of the CWA section 303(c) and the federal water quality standards regulations at 40 C.F.R. Part 131. These criteria were identified in Paragraph 9 of the Settlement Agreement in American Canoe Ass'n v. Browner, 98-1195-CV-W (W.D. Mo.) (effective date 2-27-01), as well as in the Sierra Club's petition. EPA finds that the petitioner has not demonstrated that a federal promulgation of new or revised water quality criteria for the

[12] See Attachment A

petition area is needed to meet the requirements of the CWA and the federal regulations. Therefore, EPA denies the petitioner's request to promulgate any numeric water quality criteria, at this time, for the pollutants specifically identified by the petitioner, to apply to the petition area. EPA's detailed rationale for its conclusions regarding each of the pollutants is discussed in greater detail in the following paragraphs.

a) Atrazine

Aquatic Life Protection. The petition does not identify any specific concerns with the petition states' atrazine criteria for the protection of aquatic life. Addendum 8 of the petition describes the atrazine criteria that the states have adopted for the Mississippi River. It shows that none of the states along the Mississippi River have adopted numeric atrazine criteria to protect aquatic life uses (or any other use, except drinking water, as discussed below). Neither the petition nor the addenda contain any information or discussion of atrazine criteria to protect aquatic life uses on the Missouri River.

EPA evaluated this information as well as the currently approved state water quality standards to determine if the state water quality standards are inconsistent with the CWA and federal regulations at 40 C.F.R. Part 131 such that a federal promulgation of numeric atrazine criteria for the protection of aquatic life is necessary for the petition area. EPA first reviewed the states' currently adopted and approved water quality standards to validate the petitioner's findings. Specifically, EPA looked to see whether any states have adopted numeric or narrative atrazine criteria to protect aquatic life. EPA also reviewed the petition states' 2002 section 303(d) lists[13] to determine if any state identified atrazine as a pollutant responsible for impairing an aquatic life use. Finally, EPA evaluated the scientific understanding of atrazine to determine if the science is sufficient at this time to support EPA or state development of numeric ambient water quality criteria for the protection of aquatic life.

According to EPA's evaluation of the states' water quality standards, all eight of the petition states currently have narrative criteria related to toxic pollutants that may be used for establishing NPDES permits, listing waters as impaired by atrazine on section 303(d) lists and developing TMDLs, if necessary. As discussed earlier in the "Statutory and Regulatory Background" section, narrative criteria may form the regulatory basis for these purposes. While the petition's addendum 8 indicates that no state has adopted numeric atrazine criteria, EPA found that three states, Illinois, Nebraska and Kansas, have numeric aquatic life criteria for atrazine.[14] Illinois has an EPA approved procedure for implementing their narrative criteria at Title 35, Subtitle C, Chapter 1, Section 302.210 in Illinois' water quality standards. This procedure derives numeric values to be used as ambient water quality criteria for toxic pollutants, including atrazine.[15] Nebraska

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[13] See Attachment G
[14] See Attachment B
[15] Derived Water Quality Criteria, Illinois Environmental Protection Agency <http://www.epa.state.il.us/water/water-quality-standards/water-quality-criteria.html>

and Kansas have explicitly adopted ambient water quality criteria for atrazine.[16] However, these states adopted criteria at the state's own initiative without the benefit of a final EPA CWA section 304(a) criteria recommendation. These states exercised their discretion to adopt a numeric criterion for atrazine based on other scientifically defensible methods. None of the petition states identified (nor has EPA proposed to identify) atrazine as an impairing pollutant within the petition area on their 2002 section 303(d) impaired waters list.[17]

On November 7, 2003, EPA released and requested scientific views on a revised draft ambient water quality criteria document for atrazine to protect aquatic life. This document provides EPA's draft acute and chronic criteria recommendations for atrazine designed to protect aquatic life in both freshwater and saltwater. The revised draft criteria incorporate toxicity information for atrazine that had not been available at the time EPA published its 2001 draft recommendations (see EPA's website at http://www.epa.gov/waterscience/criteria/atrazine/). In addition to revising the 2001 draft criteria recommendations to reflect scientific views EPA received from the public during the comment period, the Office of Water has been closely coordinating with the Office of Pesticide Programs (OPP) to ensure that the draft ambient water quality criteria recommendation is consistent with OPP's ecological risk assessment. OPP used its ecological risk assessment for atrazine to ensure that its decision to reregister atrazine did not result in unreasonable adverse effects.

Since EPA is currently in the process of developing a final numeric atrazine water quality criterion to protect aquatic life and atrazine may be controlled, if necessary, in all petition states based on narrative criteria where numeric atrazine criteria to protect aquatic life uses do not exist, EPA concludes that it is not necessary for EPA to promulgate numeric atrazine criteria to protect aquatic life for the petition area, at this time, to meet the requirements of the CWA under CWA section 303(c)(4)(B). Once EPA's recommendations are finalized, it is EPA's policy to allow states an appropriate amount of time to incorporate EPA's newest recommendations into their water quality standards. When EPA's section 304(a) atrazine criterion to protect aquatic life is final and states have had appropriate time to incorporate the updated science into their water quality standards, EPA will evaluate the need for a federal promulgation where it is determined that atrazine criteria are necessary to protect designated uses in the petition area.

Human Health Protection. The Sierra Club's addendum 8 shows that Iowa, Missouri and Tennessee have adopted an ambient water quality criterion for atrazine of 3 μg/L to protect drinking water supplies along the Mississippi River while Arkansas, Illinois and Kentucky have not adopted numeric criteria for atrazine. In the petition's water quality criteria section, the Sierra Club specifically expresses a concern that Kentucky, the only state that does not designate the Mississippi River for a drinking water use, does not have a numeric criterion for atrazine to protect public health. The petition does not discuss atrazine criteria to protect human health on the Missouri River.

[16] See Attachment B
[17] See Attachment G

EPA evaluated this information as well as the currently approved state water quality standards to determine if the state water quality standards are inconsistent with the CWA and federal regulations at 40 C.F.R. Part 131 such that a federal promulgation of numeric atrazine criteria for the protection of human health is necessary for the petition area. EPA first reviewed the states' currently adopted and approved water quality standards to validate the petitioner's findings. Specifically, EPA looked to see if any states have adopted numeric atrazine criteria to protect human health. EPA also reviewed the 2002 section 303(d) lists[18] to determine if any state identified atrazine as a pollutant responsible for impairing human health uses. Finally, EPA evaluated the scientific understanding of atrazine to determine if the science is sufficient at this time to support EPA or state development of numeric ambient water quality criteria to protect human health.

According to EPA's evaluation of the states' water quality standards, all of the petition area states along the Missouri River (Iowa, Nebraska, Missouri, and Kansas) apply 3 μg/l to protect public water supplies. Iowa, Missouri, and Tennessee have adopted 3 μg/l into their water quality standards to protect public water supplies on the Mississippi River. Kentucky, Illinois, and Arkansas have not adopted numeric water quality criteria for atrazine to protect human health. All eight of the petition states currently have narrative criteria related to toxic pollutants that may be used for establishing NPDES permits and TMDLs, if necessary. As discussed earlier in the "Statutory and Regulatory Background" section, narrative criteria can form the regulatory basis for these purposes. No state within the petition area has included atrazine as a pollutant on their section 303(d) impaired waters list nor did the petitioner raise any specific instances of concern in the petition.

The ambient water quality criterion of 3 μg/l that five of the eight petition area states have adopted to protect public water supplies is based on EPA's maximum contaminant level (MCL) published under § 1412(b)(4) of the Safe Drinking Water Act that applies to treated drinking water, not to ambient surface waters. EPA has not yet developed ambient water quality criteria recommendations for atrazine to protect human health under section 304(a) of the CWA because the science necessary to develop appropriate criteria for surface waters is not yet complete. Currently, the Agency is reassessing the available toxicity information on atrazine (OPP recently conducted a human health risk assessment for atrazine and concluded that there was a reasonable certainty of no harm from the reregistration of atrazine). Once this scientific evaluation is completed, EPA will consider developing ambient water quality criteria for atrazine. In the interim, states continue to have the discretion to adopt a numeric criterion for surface waters to protect human health based on other information, such as MCLs.[19]

In response to the petitioner's specific concern with respect to Kentucky, EPA concludes that since Kentucky does not use the Mississippi River as a drinking water

[18] See Attachment G

[19] U.S. Environmental Protection Agency. 1994. *Water Quality Standards Handbook: Second Edition.* Office of Water, Washington, D.C. EPA-823-B-94-005a.

source, there are no drinking water intakes across or immediately downstream from Kentucky, and Kentucky could use narrative criteria to control atrazine if necessary, Kentucky's water quality standards are consistent with the CWA and federal regulations. Therefore, it is unnecessary for EPA to federally promulgate numeric atrazine criteria for Kentucky to protect human health uses, at this time, to meet the requirements of the CWA under CWA section 303(c)(4)(B).

With regard to Illinois and Arkansas, EPA concludes that a federal promulgation is unnecessary, at this time, to meet the requirements of the CWA CWA section 303(c)(4)(B). This conclusion is based on the following facts: The science is currently under review in preparation for criteria development; the states have not specifically identified atrazine as a pollutant impairing human health uses on their impaired waters list; the petitioner has not identified any specific concerns; and the petition states' current narrative criteria provide a basis for pollutant control in the absence of numeric criteria to protect local and downstream water quality standards (40 C.F.R. §131.10(b)), if necessary. However, once EPA issues section 304(a) criteria recommendations for atrazine for the protection of human health and EPA has provided states appropriate time to incorporate the latest science into water quality standards, EPA will reevaluate the need for a federal promulgation where it is determined that atrazine criteria are necessary to protect designated uses in the petition area.

b) PCBs

The Sierra Club identifies a specific concern regarding PCB criteria for two states, Iowa and Nebraska, both of which are upstream of Missouri on the Mississippi River and the Missouri River, respectively. The Sierra Club points out that Iowa's and Nebraska's PCB criteria are nearly ten times less stringent than Missouri's PCB criteria. Petition at 13 - 14. Addenda 10 and 11 of the petition provide tables describing the PCB criterion that each petition state applies to the petition area, as evaluated by the Sierra Club, and shows that the petition states have adopted varying criteria to protect their designated uses.

EPA evaluated the information provided by the petitioner as well as the currently approved state water quality standards for all petition states to determine if the PCB criteria in the petition states' water quality standards are inconsistent with the CWA and federal regulations at 40 C.F.R. Part 131 such that a federal promulgation of numeric PCB criteria is necessary. EPA first reviewed the states' currently adopted and approved water quality standards to validate the petitioner's findings. Specifically, EPA identified exactly what numeric and/or narrative PCB criteria states have currently adopted to apply to the petition area.[20] EPA then investigated the basis for these criteria to determine if the states had adopted criteria based on EPA's recommendations or on other scientifically defensible methods. Finally, EPA looked for any documented evidence that may suggest the differences in criteria are preventing a downstream or across stream state from attaining and maintaining its water quality standards.

[20] See Attachment B

Adverse human health effects are expected at much lower concentrations of PCBs than in aquatic life. As a result, EPA's CWA section 304(a) criteria recommendations for PCB to protect human health have generally been more stringent than those to protect aquatic life. In the case where states have adopted PCB criteria to protect both human health and aquatic life, the criteria to protect human health are more likely to drive regulatory decisions. Therefore, in its evaluation of currently approved PCB criteria, EPA focused on whether the states have adopted numeric criteria for PCBs to protect human health-related designated uses. EPA acknowledges there are variations in the numeric PCB criteria adopted by the petition states. There are four legitimate reasons why the numeric PCB criteria vary within the petition area:

(1) EPA published section 304(a) criteria recommendations several times over the past 20 years. EPA's revised section 304(a) criteria recommendations reflect the most current scientific knowledge but do not always result in more stringent criteria recommendations (e.g., EPA's 1999 section 304(a) recommendations for PCB were less stringent than its 1986 section 304(a) recommendations.)[21,22] States have adopted and revised PCB criteria at different points in time. The criteria the petition states adopted depended on the recommendations and information available at that time. For example, Kentucky and Kansas adopted human health criteria based on EPA's 1986 section 304(a) criteria recommendation while Nebraska (which evaluates the aquatic life and human health criteria and adopts whichever one is most stringent) adopted human health criteria based on EPA's 1992 National Toxics Rule (See 40 C.F.R. §131.36). These values were also published as section 304(a) criteria in 1999. On the Missouri River, even though Kansas' human health criterion for PCB is more stringent than Nebraska's (the upstream state), Nebraska's criterion is in fact based on more recent science. Therefore, comparing stringency of criteria is not an adequate method of determining whether states have appropriate criteria to protect the designated uses or whether they are providing for the attainment and maintenance of downstream water quality standards as required under 40 C.F.R. §131.10(b).

(2) While EPA did not publish revised section 304(a) criteria for PCBs between 1986 and 1999, EPA updated toxicity information for PCBs in EPA's IRIS[23] database in 1989. As a result, Iowa, Missouri, Arkansas, and Tennessee took EPA's 1986 section 304(a) criteria recommendations and incorporated the new toxicity information from IRIS to derive a revised ambient water quality criterion for PCBs. States have the discretion to derive criteria based on other scientifically defensible

[21] U.S. Environmental Protection Agency. *Quality Criteria for Water*. Office of Water, Washington, D.C. < http://www.epa.gov/waterscience/criteria/goldbook.pdf > EPA 440/5-86-001. May 1986
[22] U.S. Environmental Protection Agency. *National Recommended Water Quality Criteria – Correction*. Office of Water, Washington, D.C. < http://www.epa.gov/waterscience/pc/1999table.pdf> EPA 822-Z-99-001. April 1999
[23] [23] U.S. Environmental Protection Agency . Integrated Risk Information System. < http://www.epa.gov/iriswebp/iris/index.html>

methods (40 C.F.R. §131.11). These states used EPA's method to derive criteria but used more recent toxicity information to ensure their criteria incorporated the latest scientific information at the time of adoption.

(3) As discussed in the "Statutory and Regulatory Background" section, EPA publishes section 304(a) criteria based on a 10^{-6} risk level for carcinogens; states may select a specific risk level based on their own risk management decisions. EPA believes that adoption of criteria within a risk level of 10^{-6} (one in a million incremental risk for cancer) or 10^{-5} (one in one hundred thousand incremental risk for cancer) represents an acceptable range of risk management discretion for states and tribes.[24] Within the petition states, each state adopts criteria to protect human health based on risk management decisions. Iowa, Arkansas, Tennessee, and Nebraska have adopted PCB criteria based on a 10^{-5} risk level; Illinois, Kentucky and Missouri have adopted PCB criteria based on a 10^{-6} risk level; and Kansas chose to adopt a PCB criterion to protect human health at a 10^{-7} risk level.

(4) EPA's regulations provide that states may adopt EPA's section 304(a) criteria recommendations, modify EPA's section 304(a) criteria to reflect site-specific conditions, or derive and adopt criteria based on other scientifically defensible methods. (40 C.F.R. §131.11 (b)). Illinois developed a procedure to translate its narrative criteria and derive numeric values for certain pollutants. EPA determined that this procedure is scientifically defensible and considers the numeric values derived using this procedure to be within the acceptable range to protect designated uses. Illinois uses this procedure to derive numeric values for PCBs that may be used to issue NPDES permits, to determine if a waterbody is impaired for PCBs and thus listed under CWA section 303(d) listings, and/or to develop a TMDL.

As discussed above, Iowa and Missouri adopted a numeric PCB criterion to protect human health based on the toxicity information available in IRIS that was updated in 1989. With regard to the Sierra Club's specific concern about Iowa's PCB criterion as compared to Missouri's criterion, EPA found that Iowa's criterion is an order of magnitude greater than Missouri's because Iowa has chosen to protect human health at a 10^{-5} risk level while Missouri protects human health at a 10^{-6} risk level. With regard to the Sierra Club's specific concern about Nebraska's PCB criterion as compared to Missouri, EPA found that Nebraska adopted a numeric PCB criterion to protect human health based on EPA's section 304(a) criteria recommendations published in 1999 (Missouri used the updated 1999 IRIS data), but chose a 10^{-5} risk level. As a result, Nebraska's PCB criterion is greater than Missouri's criterion.

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[24] U.S. Environmental Protection Agency. *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000).* Office of Water. Washington, D.C. EPA-822-B-00-004. <http://www.epa.gov/waterscience/humanhealth/method > October 2000.

As described in the "Statutory and Regulatory Background" section, the regulations do not compel states to adopt the same criteria and uses in order to provide for attainment and maintenance of downstream water quality standards (40 C.F.R. §131.10(b)), nor do the regulations suggest that this is the only way a state can meet the requirements under § 131.10(b). The water quality program is structured to provide states with flexibility to determine the best way to protect their designated uses and meet their obligations under § 131.10(b). The petitioner has not provided any specific instances where the differences in PCB criteria are preventing a downstream or across stream state from attaining its designated uses as required by 40 C.F.R. §131.10(b).

The PCB criteria adopted by the petition states vary due to any one or a combination of the above reasons. EPA found that the petition states adopted criteria based on an EPA section 304(a) criteria recommendation or another scientifically defensible method and these criteria are within the scientifically acceptable range to protect designated uses consistent with 40 C.F.R. §131.11. In addition, since the production of PCBs have been banned in the United States, EPA believes it is unlikely that any differences in criteria will lead to future increases in the discharge of PCBs. While the petition states do apply different numeric PCB criteria to the petition area and some states have listed certain segments of the petition area waters as impaired for PCBs, EPA is unaware of any evidence that indicates the impairments are a result of anything but local water quality or sediment quality issues. Therefore, EPA has no reason to believe that an upstream or across stream state is causing the impairments. For example, on the Missouri River, while Missouri lists the Missouri River as impaired at the Iowa/Missouri state line due to PCBs, Iowa does not. EPA has no reason to believe that the mere listing of the Missouri River for PCBs is due to the different PCB criterion in Iowa instead of water quality issues wholly within the state of Missouri. Since the petition states have adopted PCB criteria based on EPA recommendations or other scientifically defensible methods, states have mechanisms available to them to ensure downstream water quality standards are attained and maintained, if necessary, and because the petitioner has not provided any specific instances (nor has EPA identified) where the differences in PCB criteria are preventing a downstream or across stream state from attaining its designated uses (40 C.F.R. §131.10(b)), EPA concludes that it is unnecessary for EPA to federally promulgate numeric PCB criteria for the petition states at this time, to meet the requirements of the CWA under CWA section 303(c)(4)(B).

c) Chlordane

The Sierra Club identifies a specific concern regarding chlordane criteria for two states, Iowa and Nebraska. The Sierra Club specifically points out that Iowa's and Nebraska's chlordane criteria are nearly ten times less stringent than Missouri's chlordane criteria. Petition at 13 – 14. Addenda 12 and 13 of the petition provide tables describing the chlordane criteria that each petition state applies to the petition area, as evaluated by the Sierra Club, and shows that the petition states have adopted varying criteria to protect their designated uses.

EPA evaluated the information provided by the petitioner as well as the currently approved state water quality standards for all petition states to determine if any of the chlordane criteria in the petition states' water quality standards are inconsistent with the CWA and federal regulations at 40 C.F.R. Part 131 such that a federal promulgation of numeric chlordane criteria is necessary. EPA first reviewed the states' currently adopted and approved water quality standards to validate the petitioner's findings. Specifically, EPA identified exactly what numeric and/or narrative chlordane criteria states have adopted to apply to the petition area.[25] Then EPA investigated the basis for these criteria to determine if states had adopted criteria based on EPA's recommendations or on other scientifically defensible methods. Finally, EPA looked for any documented evidence that may suggest the differences in criteria are preventing a downstream or across stream state from attaining and maintaining its water quality standards.

Adverse human health effects are expected at much lower concentrations of chlordane than in aquatic life. As a result, EPA's criteria recommendation for chlordane to protect human health is generally more stringent than those to protect aquatic life. In the case where states have adopted chlordane criteria to protect both human health and aquatic life, the criteria to protect human health are more likely to drive regulatory decisions. Therefore, in its evaluation of currently approved chlordane criteria, EPA focused on whether states have adopted numeric criteria for chlordane to protect human health-related designated uses. EPA acknowledges that there are variations in the numeric chlordane criteria adopted by the petition states. There are three legitimate reasons why the numeric chlordane criteria vary within the petition area:

(1) EPA published section 304(a) criteria recommendations several times over the past 20 years. EPA's revised section 304(a) criteria reflects the current scientific knowledge but does not always result in more stringent criteria recommendations (e.g., EPA's 1999 section 304(a) recommendations for chlordane were less stringent than its 1986 section 304(a) recommendations.)[26,27] States have adopted and revised chlordane criteria into their water quality standards at different points in time. The criteria the petition states adopted depended on the recommendations and information available at that time. For example, Missouri, Kansas, and Nebraska (Nebraska evaluates the aquatic life and human health criteria and adopt whichever one is most stringent) adopted human health criteria based on EPA's 1986 section 304(a) criteria recommendation while Iowa and Kentucky adopted human health criteria consistent with EPA's 1992 National Toxics Rule (see 40 C.F.R. §131.36). On the Mississippi River, even though Missouri's human health criterion for chlordane is more stringent than Kentucky's (the across stream state), Kentucky's criterion is, in fact, based on more recent science. Therefore, comparing stringency

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[25] See Attachment B

[26] U.S. Environmental Protection Agency. *Quality Criteria for Water*. Office of Water, Washington, D.C. < http://www.epa.gov/waterscience/criteria/goldbook.pdf > EPA 440/5-86-001. May 1986

[27] U.S. Environmental Protection Agency. *National Recommended Water Quality Criteria – Correction*. Office of Water, Washington, D.C. < http://www.epa.gov/waterscience/pc/1999table.pdf> EPA 822-Z-99-001. April 1999.

of criteria is not always an adequate method of determining whether states have appropriate criteria to protect the designated uses or whether they are providing for the attainment and maintenance of downstream water quality standards as required under 40 C.F.R. §131.10(b).

(2) As discussed in the "Statutory and Regulatory Background" section, EPA publishes section 304(a) criteria based on a 10^{-6} risk level for carcinogens; states may select a specific risk level based on their own risk management decisions. EPA believes that adoption of criteria within the risk level of 10^{-6} (one in a million incremental risk for cancer) or 10^{-5} (one in one hundred thousand incremental risk for cancer) represents an acceptable range of discretion for states and tribes.[28] Within the petition states, each state adopts criteria to protect human health based on different risk management decisions. Iowa, Arkansas, Tennessee, and Nebraska have adopted chlordane criteria based on a 10^{-5} risk level while Illinois, Kentucky, Kansas and Missouri have adopted chlordane criteria based on a 10^{-6} risk level.

(3) EPA's regulations provide that states may adopt EPA's section 304(a) criteria recommendations, modify EPA's section 304(a) criteria to reflect site-specific conditions, or derive and adopt criteria based on other scientifically defensible methods. (40 C.F.R. §131.11 (b)). Illinois developed a procedure to translate its narrative criteria and derive numeric values for certain pollutants. EPA determined that this procedure is scientifically defensible and considers the numeric values derived using this procedure to be within the acceptable range to protect designated uses. Illinois uses this procedure to derive numeric values for chlordane that may be used to issue NPDES permits, to determine if a waterbody is impaired for chlordane and thus listed under CWA section 303(d) listings, and/or to develop a TMDL.

With regard to the Sierra Club's specific concern about Iowa's chlordane criterion as compared to Missouri's criterion, EPA found that Missouri adopted a numeric chlordane criterion to protect human health based on EPA's 1986 section 304(a) criteria recommendation, while Iowa adopted human health criterion consistent with EPA's National Toxics Rule. Iowa's chlordane criterion is an order of magnitude greater than Missouri's because Iowa has chosen to protect human health at a 10^{-5} risk level while Missouri protects human health at a 10^{-6} risk level. With regard to the Sierra Club's specific concern about Nebraska's chlordane criterion as compared to Missouri's criterion, EPA found that both Missouri and Nebraska adopted chlordane criteria based on EPA's 1986 section 304(a) criteria, however, Nebraska's policy is to evaluate the aquatic life and human health criteria and to adopt whichever is most stringent to protect both aquatic life and human health. In 1986, EPA's section 304(a) criteria

[28] U.S. Environmental Protection Agency. *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000).* Office of Water, Washington, D.C. EPA-822-B-00-004. <http://www.epa.gov/waterscience/humanhealth/method > October 2000.

recommendation to protect aquatic life was slightly more stringent than the 10^{-5} human health recommendations. Nebraska adopted one criterion to protect for both aquatic life and human health by adjusting EPA's recommended human health criterion for chlordane to protect human health at a 10^{-5} risk level. Therefore, the magnitude of Nebraska's chlordane criteria is close to an order of magnitude greater than Missouri's criterion because while Nebraska has chosen to protect human health at a 10^{-5} level, Missouri protects human health at a 10^{-6} risk level.

As discussed earlier, the regulations do not compel states to adopt the same criteria and uses in order to provide for attainment and maintenance of downstream water quality standards (40 C.F.R. §131.10(b)), nor do the regulations suggest that this is the only way a state can meet the requirements under § 131.10(b). The water quality program is structured to provide states with flexibility to determine the best way to protect their designated uses and meet their obligations under § 131.10(b). The petitioner has not provided any specific instances where the differences in chlordane criteria are preventing a downstream or across stream state from attaining its designated uses (40 C.F.R. §131.10(b)).

The chlordane criteria adopted by the petition states vary due to any one or a combination of the above reasons. EPA found that the petition states adopted criteria based on an EPA section 304(a) criteria recommendation or another scientifically defensible method and these criteria are within the scientifically acceptable range to protect designated uses consistent with 40 C.F.R. §131.11. In addition, since the use of chlordane has been banned in the United States, EPA believes it is unlikely that any differences in states' criteria will lead to a future increase in discharge of the pollutants. While the petition states do apply different numeric chlordane criteria to the petition area and some states have listed certain segments of the petition area waters as impaired for chlordane, EPA is unaware of any evidence that indicates the impairments are a result of anything but local water quality or sediment quality issues. Therefore, EPA has no reason to believe that an upstream or across stream state is causing the impairments. For example, on the Missouri River, while Missouri lists the Missouri River as impaired at the Iowa/Missouri state line due to chlordane, Iowa does not. EPA has no reason to believe that the mere listing of the Missouri River for chlordane is due to the different chlordane criterion in Iowa instead of water quality issues wholly within the state of Missouri. Since the petition states have adopted chlordane criteria based on EPA recommendations or other scientifically defensible methods, states have mechanisms available to them ensure downstream water quality standards are attained and maintained, if necessary, and because the petitioner has not provided any specific instances (nor has EPA identified) where the differences in chlordane criteria are preventing a downstream or across stream state from attaining its designated uses (40 C.F.R. §131.10(b)), EPA concludes that it is unnecessary for EPA to federally promulgate numeric chlordane criteria for the petition states, at this time, to meet the requirements of the CWA under CWA section 303(c)(4)(B).

d) *E. coli*/enterococci

The Sierra Club requests that EPA ensure water quality standards are adequate in the petition area by publishing water quality standards that include numeric criteria for *E. coli* and enterococci. Further, the Sierra Club illustrates its assertion that states protect their designated uses inconsistently by pointing out that Missouri's narrative criteria (i.e. lack of numeric criteria) for fecal coliform may be less protective than the numeric fecal coliform criteria that Nebraska and Kansas apply to the Missouri River. (See also discussion in "Recreation" section.) The Sierra Club concludes that this apparent inconsistency causes Nebraska and Kansas to violate water quality standards where they share a border with Missouri. Petition at 14. Addendum 14 of the petition describes which states have adopted fecal coliform criteria for the Missouri River and shows that Missouri is the only state along the Missouri River within the petition area that has not adopted a fecal coliform criterion of 200 organisms per 100 milliliters. The petition's addendum also shows that no state along the Missouri River in the petition area has adopted *E. coli* or enterococci criteria. Neither the petition nor its addenda include any information regarding the applicability of fecal coliform, *E. coli*, or enterococci criteria for the Mississippi River.

EPA evaluated the information submitted by the petitioner as well as the currently approved state water quality standards to determine if the petition states' water quality standards are inconsistent with the CWA and federal regulations at 40 C.F.R. Part 131 such that a federal promulgation of numeric bacteria criteria is necessary. EPA first reviewed the states' currently adopted and approved water quality standards to validate the petitioner's findings. Specifically, EPA evaluated state adopted numeric bacteria criteria to protect recreational uses and whether these are consistent with EPA's latest scientific recommendation.[29] EPA then sought to understand where various states were in their water quality standards review process to determine if any state is in the process of revising its bacteria criteria or is planning to in the near future.

EPA published its latest recommendation for bacteria criteria in 1986.[30] This 1986 criterion recommended that states adopt *E. coli* or enterococci as indicators for gastrointestinal illness in fresh recreation waters instead of fecal coliform, as previously recommended. Of the eight states in the petition area, Kansas, Nebraska, Iowa and Tennessee have adopted and EPA has approved *E. coli* criteria to protect a primary contact recreation use in the Mississippi and/or Missouri Rivers. Arkansas has adopted *E. coli* criteria and EPA expects Arkansas to submit revised water quality standards to EPA in June 2004. Kentucky has proposed adopting *E. coli* in its state rulemaking process and EPA expects Kentucky to submit revised water quality standards to EPA in the fall of 2004. On November 7, 2003, Missouri sent EPA a formal letter committing to adopt *E. coli* criteria for the petition area by July 2005. On March 23, 2004, Illinois sent EPA a formal letter committing to initiate adoption of *E. coli* criteria into water quality standards by September 30, 2004.

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[29] See Attachment B

[30] U.S. Environmental Protection Agency. *Ambient Water Quality Criteria for Bacteria – 1986*. Office of Water, Washington, D.C. EPA 440/5-84-002. < http://www.epa.gov/waterscience/beaches/1986crit.pdf> January 1986.

In its 1986 guidance, EPA recommended that states adopt *E. coli* or enterococci criteria in order to protect contact recreation uses in freshwaters, including those within the petition area, and enterococci in marine waters. Congress endorsed EPA's recommendation in 2000 with respect to coastal waters when it amended the CWA by enacting the Beaches Environmental Assessment and Coastal Health Act of 2000 (BEACH Act). The newly added CWA section 303(i) requires, by April 2004, that states "…adopt and submit to the Administrator water quality criteria and standards for the coastal recreation waters of the state for those pathogens and pathogen indicators for which the Administrator has published criteria under section 304(a)." (Coastal waters are defined in section 502(21) to include waters of the Great Lakes and marine coastal waters designated for use for swimming, boating, surfing, and similar water contact activities.) Further, section 303(i) directs EPA to propose and promulgate standards as protective as the 1986 criteria recommendations for states that fail to comply with section 303(i).

Based on the current scientific knowledge, EPA continues to recommend that states adopt *E. coli* or enterococci criteria to protect recreation waters. As described earlier, the CWA provides EPA the discretionary authority to set a new or revised standard for a state if the Administrator determines that new or revised water quality standards are necessary to meet the requirements of the CWA. However, with regard to the petition area, EPA concludes that it is unnecessary to initiate a rulemaking to promulgate federal *E. coli* or enterococci criteria for the petition area at this time to meet the requirements of the CWA under CWA section 303(c)(4)(B) since all eight states have either adopted *E. coli* or enterococci criteria, proposed adoption, or have committed to adopting such criteria to protect recreation uses in the petition area within a reasonable timeframe. EPA's decision is consistent with Congress' intent to "recognize, preserve, and protect the primary responsibilities and rights of states to prevent, reduce, and eliminate pollution…of … water resources." CWA Section 101(b).

Further, EPA believes the BEACH Act expresses Congress's intent for EPA to address the nation's coastal recreation waters as a first priority to ensure appropriate bacteria criteria are in place to protect beachgoers. As a result, EPA is focusing its efforts to assist states in adopting bacteria criteria consistent with the requirements under CWA section 303(i) and intends to promulgate bacteria criteria for coastal recreation waters, where necessary. If, however, Kentucky, Arkansas, Missouri or Illinois fail to follow through on their commitment to adopt appropriate bacteria criteria for the petition area, EPA will, if necessary, initiate a federal rulemaking to establish *E. coli* or enterococci criteria for the petition area within these states.

e) Dissolved Oxygen

While listed as one of the pollutants at issue, neither the petition nor the addenda to the petition discuss any specific issues/concerns related to numeric dissolved oxygen criteria in the petition area. Nonetheless, in the absence of any information from the petitioner, EPA analyzed currently approved state water quality standards, in conjunction with implementation procedures that further describe how the state implements its water quality standards, and found that all of the petition states apply a dissolved oxygen criterion of 5 mg/l to protect aquatic life consistent with the CWA.[31] Therefore, it is unnecessary for EPA to federally promulgate numeric dissolved oxygen criteria for the petition area, at this time, to meet the requirements of the CWA under CWA section 303(c)(4)(B

f) Ammonia

While listed as one of the pollutants at issue, neither the petition nor the addenda to the petition discuss any specific issues/concerns related to numeric ammonia criteria in the petition area. Nonetheless, in the absence of any information from the petitioner, EPA evaluated the petition states' currently approved water quality standards to determine if the petition states' water quality standards are inconsistent with the CWA and federal regulations at 40 C.F.R. Part 131 such that a federal promulgation of numeric ammonia criteria is necessary. EPA first reviewed the states' currently adopted and approved water quality standards to validate the petitioner's findings. Specifically, EPA looked to see whether any states have adopted numeric and/or narrative ammonia criteria to protect aquatic life consistent with EPA's recommendations.[32] If the criteria varied state to state, EPA looked to see why the criteria varied and whether the variation was within the states' scientific discretion and whether the resulting criteria were protective of the designated use. Finally, EPA looked at the petition states' 2002 section 303(d) impaired waters lists[33] to determine if any petition state identified ammonia as an impairing pollutant responsible for impairing aquatic life uses.

All eight of the petition states have adopted numeric ammonia criteria applicable to the portions of the Mississippi and Missouri Rivers within their jurisdiction. Kansas, Iowa, Nebraska and Tennessee adopted numeric ammonia criteria identical to EPA's most recent section 304(a) criteria recommendation published in 1999. Missouri, Illinois, and Kentucky have adopted criteria based on EPA's section 304(a) recommendations published before 1999. Arkansas adopted numeric ammonia criteria on April 23, 2004 and is expected to submit their revised water quality standards for EPA review and approval in June 2004. In the interim, Arkansas's narrative criterion may be used to control ammonia levels, if necessary, through water quality-based NPDES limits or TMDLs.[34] In EPA's review of the petition states' section 303(d) lists[35], no state within the petition area included (nor did EPA propose to include) ammonia as a pollutant impairing designated uses.

In developing its 304(a) criteria recommendations, EPA took into account the fact that ammonia is a complex pollutant with its effect on aquatic life dependent on several

[31] See Attachment B
[32] See Attachment B
[33] See Attachment G
[34] See Attachment A
[35] See Attachment G

factors, including temperature and pH. EPA's most recent recommended criteria reflect these complexities by providing numeric calculation approaches that consider these two variables. Further, states may modify EPA's section 304(a) criteria recommendations based on their own analysis of the available toxicity data taking into account local characteristics. In addition, EPA has not recommended a specific method to determine the appropriate temperature and pH to use when deriving numeric ammonia criteria. As a result, states may use temperature and pH differently leading to variations in the derived state numeric ammonia criteria. EPA evaluated these states' currently adopted and approved numeric ammonia criteria taking into account these variations and determined that all of the numeric ammonia criteria values applied by the petition states to the petition area are within the scientifically reasonable range and are expected to protect the designated uses consistent with the federal regulations at 40 C.F.R. §131.11. EPA continues to work with all states to ensure the latest scientific knowledge regarding ammonia is incorporated into state water quality standards.

Since ammonia criteria will generally vary with pH and temperature, any comparison of stringency among the state criteria depends on the pH and temperature used for the comparison. Scientifically, it is unclear what the most relevant pH and temperature conditions would be for making such comparisons. Therefore, it is not possible to rank, with confidence, state ammonia criteria by stringency. As mentioned earlier, the petition did not identify any specific instances of concern related to numeric ammonia criteria in the petition states nor do any of the petition states identify ammonia as an impairing pollutant on their section 303(d) list. Taking this into consideration as well as the fact that seven of the eight states' currently approved ammonia criteria are within the scientifically reasonable range and are expected to protect the designated uses consistent with the federal regulations at 40 C.F.R. §131.11 and the remaining state (Arkansas) has adopted a numeric ammonia criterion, EPA concludes it is unnecessary to federally promulgate numeric ammonia criteria for the petition area, at this time, to meet the requirements of the CWA under CWA section 303(c)(4)(B).

g) Nutrients

The Sierra Club raises several concerns regarding nutrients in the petition. They assert that states inconsistently apply numeric criteria for nitrogen and phosphorus to the Mississippi and Missouri and that inadequate nutrient criteria in the petition area contributes to the hypoxic zone in the Gulf of Mexico. Petition at 17. Regarding the petitioner's concern of inconsistent nutrient criteria, the Sierra Club specifically indicates that Kentucky has a narrative criterion while neighboring Missouri has a numeric nitrogen criterion and that Arkansas is the only state in the petition area to apply a numeric phosphorus criterion to the Mississippi River. Petition at 13 – 14. Addenda 9 and 15 appear to support these examples of inconsistent criterion on the Mississippi River and offer additional information, but only describe the criteria applicable to the Mississippi River and not the Missouri River within the petition area.

To support their request that EPA publish numeric criteria for nutrients in the petition area, the Sierra Club referred to a recent General Accounting Office (GAO) report that stated "sediments, nutrients and pathogens (including *E. coli* and enterococci) - account for fifty percent [sic] of the impaired waters nationwide." The petitioner goes on to state that despite this statistic, EPA has not developed recommendations for numeric water quality criteria for nutrients. Petition at 15 – 16. The GAO report indicates that EPA is in the process of developing numeric criteria for nutrients.[36]

EPA evaluated the petition information as well as the currently approved state water quality standards to determine if the petition states' water quality standards are inconsistent with the CWA and federal regulations at 40 C.F.R. Part 131 such that a federal promulgation of numeric nutrient criteria is necessary. EPA first looked to see which states have adopted numeric nitrogen or phosphorus criteria to protect designated uses. Second, EPA looked to see if the petition states have adopted narrative criteria for nutrients and whether there are accompanying procedures to derive numeric criteria. Third, EPA identified the current state efforts and where the petition states are in their process to adopt numeric criteria based on the latest scientific information. Finally, EPA collected information regarding the scientific understanding of nutrients and designated uses (in local waters and the effect on the Gulf of Mexico) to determine if the science is sufficient, at this time, to support EPA or state development of numeric ambient water quality criteria for the Mississippi and Missouri Rivers.

Based on its evaluation, EPA found that Tennessee recently adopted, and EPA approved, narrative criteria for nutrients along with a procedure to derive numeric nutrient criteria applicable to free flowing streams to protect designated uses from the effects of excessive algal growth. Kansas applies numeric criterion for elemental phosphorus for the petition area. Iowa, Illinois, Missouri, Nebraska, and Kansas apply a numeric criterion for nitrates and/or nitrites to the petition area to protect human health. Arkansas has recently adopted narrative criteria for nutrients in place of previous numeric phosphorus guidelines (which is not considered to be a criterion). However, through its implementation procedures approved by EPA, Arkansas does establish point source discharge limits for nitrate-nitrogen to protect drinking water uses in surface waters.[37] EPA is currently working with these states to determine if additional criteria or procedures are necessary for nitrogen and phosphorus to protect surface waters from adverse effects due to nutrient overenrichment. All eight petition states have narrative criteria applicable to nutrients that may be used for establishing NPDES permits, listing waters as impaired by nutrients on section 303(d) lists and developing TMDLs, if necessary.

As indicated earlier, the petitioner further expresses its concern regarding nutrients in the Mississippi and Missouri Rivers by referencing the hypoxic zone in the

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[36] General Accounting Office. *Water Quality: Improved EPA Guidance and Support Can Help States Develop Standards that Better Target Cleanup Efforts*. GAO-03-308 <http://www.gao.gov/new.items/d03308.pdf> (January 2003). p 37.

[37] Arkansas Department of Environmental Quality. *Arkansas Water Quality Planning and Management: State Continuing Planning Process*. Little Rock, Arkansas. 1999.

northern Gulf of Mexico as "a graphic demonstration of the inadequacy of current water quality standards in the vicinity of the petition area." Petition at 16. While the Sierra Club specifically quotes the discussion contained in The Mississippi River/Gulf of Mexico Watershed Nutrient Task Force's *Action Plan for Reducing, Mitigating, and Controlling Hypoxia in the Northern Gulf of Mexico* regarding the significant impact of nutrients carried to the Gulf (from the Mississippi River basin) on the Hypoxic zone, the *Action Plan* also states that "There are no simple solutions that will reduce hypoxia in the Gulf. An optimal approach would take advantage of the full range of possible actions to reduce nutrient loads and increase nitrogen retention and denitrification."[38]

According to the *Action Plan*, 56% of the nitrate load enters the Mississippi River above the Ohio River and the Ohio River basin itself adds 34% of the nitrate load. About 90% of the total nitrate load to the Gulf comes from nonpoint sources. Modeling by Alexander et al (2000)[39] indicates that more than 90% of the nitrate reaching the Mississippi River will be transported downstream to the Gulf of Mexico. This implies that the Mississippi River primarily transports nutrients downstream with little or no processing or removal of nitrogen occurring.[40,41] Battaglin et al (2001) believe that the ability of the Mississippi River to process nitrate normally is being overwhelmed by the nitrate loads from upstream sources. As a result, the Mississippi River is unable to achieve the net decrease in nitrate amounts that normally would occur. USGS studies show that denitrification could be optimized in the Upper Mississippi River (source of Mississippi River to confluence with Illinois River) by diverting water from the river to off-channel "backwater" areas that have conditions to promote nitrogen removal during non-flooding periods. However, even optimal denitrification in the Upper Mississippi River would only result in 5-10% reduction in load to the Gulf of Mexico.[42] The ability to use this method to achieve optimal denitrification in the middle and lower Mississippi Rivers is very small since the River is essentially disconnected from the carbon-rich floodplain ecosystem that could help process nitrogen, by flood control levees.[43] In other words, even if the Mississippi River could optimally process nitrogen like many other waters, the amount of nitrogen being loaded into the river prevents the river from reducing total nitrogen loadings into the Gulf more than 10%. These studies emphasize how complex the nutrients problem is in the Mississippi River basin and the need for states to control nutrients at the source.

In 2001, EPA began providing states with waterbody specific technical guidance manuals and numeric nutrient criteria recommendations for states to use as starting points

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[38] Mississippi River/Gulf of Mexico Watershed Nutrient Task Force. *Action Plan for Reducing, Mitigating, and Controlling Hypoxia in the Northern Gulf of Mexico.* http://www.epa.gov/msbasin/actionplan.htm. January 2001.
[39] Alexander, R.B., Smith, R.A., and Schwarz, G.E. 2000. *Effect of stream channel size on the delivery of nitrogen to the Gulf of Mexico*. Nature 403: 758-761.
[40] Richardson, W.B., Strauss, E.A., Bartsch, L.A., Monroe, E.M., Cavanaugh, J.C., Vingum, L., and Soballe, D.M. *Denitrification in the Upper Mississippi River: rates, controls, and contribution to the nitrate flux.* (in press).
[41] Battaglin, W.A., Kendall, C., Chang, C.C.Y., Silva, S.R., and Campbell, D.H. 2001. Chemical and isotopic evidence of nitrogen transformation in the Mississippi River, 1997-1998. Hydrol. Process. 15: 1285-1300.
[42] Richardson, W.B., Strauss, E.A., Bartsch, L.A., Monroe, E.M., Cavanaugh, J.C., Vingum, L., and Soballe, D.M. *Denitrification in the Upper Mississippi River: rates, controls, and contribution to the nitrate flux.* (in press).
[43] U.S. Geological Survey. *Nutrients in the Upper Mississippi River: Scientific Information to Support Management Decision, The Upper Mississippi River – Values and Vulnerability*. USGS Fact Sheet 105-03. July 2003.

to protect aquatic life from eutrophication resulting from excessive nutrients, not just toxic effects. EPA has provided nutrient criteria recommendations for most of the freshwater in the nation, excluding wetlands (see http://www.epa.gov/ost/standards/nutrient.html).

States throughout the United States have been working with EPA to develop appropriate nutrient criteria plans to quantitatively address nutrients in their waters. EPA expects these plans to be developed collaboratively with EPA and to include descriptions of the approach the state will use to develop criteria, the relative priorities of waterbodies or waterbody type, data collection plans, and a schedule describing the major milestones for developing and adopting nutrient criteria. EPA's policy was described to the states in a November 14, 2001, memo available at http://www.epa.gov/waterscience/criteria/nutrientswqsmemo.pdf. Since data are more readily available and the science is better understood for lakes, reservoirs and tributaries to the Mississippi and Missouri Rivers, states have generally indicated in their plans that they are focusing on developing nutrient criteria for these waters prior to adopting quantitative nutrient criteria specifically for the Mississippi and Missouri Rivers.

EPA believes that it is important that states establish quantitative nutrient criteria, where necessary to protect designated uses, for all waters where criteria can be developed based on sound science. The studies discussed above support EPA's position that state adoption and implementation of nutrient criteria for tributaries of the Mississippi and Missouri Rivers will lead to an overall reduction of nutrient loadings in the Mississippi and Missouri River basin. These reductions will improve water quality and help protect the designated uses of these rivers as well as the Gulf of Mexico, in the near term. Therefore, while states are not currently focused on adopting quantitative nutrient criteria specifically for the Mississippi and Missouri Rivers, EPA believes that the states in the petition area are appropriately focusing attention and resources on the smaller waterbodies that flow into these rivers before addressing these two large rivers themselves. EPA intends to work with the states to establish quantitative nutrient criteria for these waters. As a result, EPA also expects, as the *Action Plan* states, that "…. actions taken to address local water quality problems in the basin will frequently also contribute to reductions in nitrogen loadings to the Gulf."[44]

EPA will work closely in the petition area with the five states that have not yet provided EPA with draft nutrient criteria plans to ensure that an appropriate approach and timeframe to develop nutrient criteria is established consistent with its November 2001 policy memo. EPA will work with the other states in the petition area that have developed nutrient criteria plans to ensure successful implementation. Whether a state has developed a nutrient criteria plan or not, EPA expects states to adopt nutrient criteria for the tributaries to the petition area in a timeframe consistent with EPA's guidance in the November 2001 policy memo and will evaluate the need to promulgate federal nutrient criteria, as necessary, if a state fails to do so. In the interim, petition states'

[44] Mississippi River/Gulf of Mexico Watershed Nutrient Task Force. *Action Plan for Reducing, Mitigating, and Controlling Hypoxia in the Northern Gulf of Mexico.* http://www.epa.gov/msbasin/actionplan.htm. January 2001.

narrative criteria may serve as the basis for NPDES permits, section 303(d) listings and TMDLs, if necessary.

Although EPA has provided nutrient criteria recommendations for the ecoregions that encompass the Mississippi and Missouri Rivers, EPA's water quality criteria recommendations for nutrients are based on a reference condition approach (a reference condition reflects minimally impacted water quality conditions). In deriving the criteria recommendations, EPA incorporated data from the Mississippi and Missouri Rivers, however, since EPA's recommendations are based on reference conditions and are statistically derived to generally protect the designated uses of specific waterbody types in a specific ecoregion, it is not likely that EPA's approach which takes the 25th percentile of data from all flowing waterbodies in the ecoregions containing the Mississippi and Missouri Rivers will generate a reference condition value appropriate to base development of a nutrient criterion for these rivers. The Mississippi and Missouri Rivers have unique qualities (i.e., flow, depth, temperature and nutrient-algal response relationships) in their respective ecoregions, and EPA believes further consideration of historical data and water quality conditions are necessary before establishing nutrient criteria specifically for these rivers. Until more monitoring and research have been conducted to better understand how these large and complex rivers respond to nutrient enrichment, establishing numeric nutrient criteria for the petition area, today, would be less meaningful and effective than ensuring that quantitative nutrient criteria are adopted for waters where the linkage between nutrient concentrations and biological response are better understood and where the sources of nutrient loadings can be adequately controlled.

The *Action Plan* acknowledges the complex nature of nutrient cycling in the Mississippi and Atchafalya River basins as well as the Gulf of Mexico. As a result, it is "…difficult to predict specific improvements in water quality that will occur both in the Gulf as well as the entire Mississippi River basin for a given course of action….Further, …while the current understanding of the causes and consequences of Gulf of Mexico hypoxia is drawn from a massive amount of direct and indirect evidence collected and reported over many years of scientific inquiry, significant uncertainties remain. Further monitoring, modeling, and research are needed to reduce those uncertainties in future assessments and to aid decision making in an adaptive management framework." The Mississippi River/Gulf of Mexico Watershed Nutrient Federal, State, and Tribal Task Force (Nutrient Task Force) was chartered in 1998 to understand the causes and effects of eutrophication in the Gulf of Mexico and to coordinate activities to reduce the size, severity and duration of the Hypoxic zone and its effects. To combat the issues identified in the *Action Plan*, the Nutrient Task Force is developing the document *A Strategy for Monitoring, Modeling, and Research in Support of Managing Excess Nutrients in the Mississippi River Basin and Hypoxia in the Northern Gulf of Mexico*, that is intended to describe a framework for implementing monitoring, modeling, and research activities. This framework will provide a sound basis of scientific information to support implementation of a management plan to address nutrient over-enrichment in the Mississippi River basin and Hypoxia in the northern Gulf of Mexico. Scientific information will be provided in an adaptive-management framework through monitoring and periodic interpretation, model analysis, and continual improvement in knowledge and methods by supporting research. The Task Force is also investigating ways to track how existing federal, state, and local efforts are likely to decrease the size of the hypoxic zone.

Once the complex effects of nutrients unique to the Mississippi River basin and their affect on the hypoxic zone in the Gulf of Mexico are better understood, EPA will be able to confidently evaluate whether states have adopted nutrient criteria into water quality standards that adequately protect designated uses in the Mississippi and Missouri Rivers and the Gulf of Mexico, and ascertain whether federally promulgated nutrient criteria are needed. EPA has taken a strong leadership role in the Nutrient Task Force's efforts to establish a strategy to reduce the size of the hypoxic zone and is working with federal and state partners to investigate remaining scientific uncertainties. EPA agrees with the petitioner that it is important that states establish quantitative nutrient criteria for the Mississippi and Missouri Rivers to protect designated uses and serve as appropriate benchmarks for nutrient controls. Yet, EPA also believes that nutrient criteria must be based on sound science. Therefore, EPA intends to continue its leadership role on nutrients and facilitate federal and state collaborative efforts that will support the development and adoption of quantitative nutrient criteria into water quality standards that will not only protect against local effects of nutrients within the Mississippi River basin, but also help to reduce the size of the hypoxic zone in the Gulf of Mexico. EPA will work with key partners to determine the appropriate ambient water quality criteria for nutrients necessary to protect the unique ecosystems of the Mississippi and Missouri Rivers based on a sound scientific understanding of the relationship between nutrient concentrations and the biological response in these rivers.

EPA believes the most effective way to begin to address ambient water quality criteria for nutrients in the Mississippi and Missouri Rivers is to reach a consensus with the affected entities on a coordinated approach on addressing nutrients in the basin. Therefore, EPA will convene key partners at a multi-day national workshop to discuss the development and adoption of appropriate ambient water quality criteria for nutrients into water quality standards for the Mississippi and Missouri Rivers that will protect the rivers and the Gulf of Mexico. The workshop will include invitees from various federal agencies (e.g., U.S. EPA's Office of Water and Office of Research and Development, U.S. Geological Survey, and U.S. Department of Agriculture), states and other stakeholders with the objective of identifying the existing federal and state nutrients efforts along the Mississippi River, the Missouri River and the Gulf of Mexico; understanding the current state of the science and the barriers states are facing; determining additional research needs and priorities; and how federal and state agencies and stakeholders can work together to develop quantitative nutrient criteria for the Mississippi and Missouri Rivers. Following the workshop, EPA will publish a report to summarize the results of the workshop and identify next steps. This report will establish a roadmap for how EPA intends to work with its partners to address nutrients in the Mississippi and Missouri Rivers. This effort will also be closely linked with the Task Force to ensure that all related nutrient work is effectively coordinated. EPA has identified the needed funds and will begin planning the workshop immediately with the intent to hold the workshop in 2005. EPA agrees with the petitioner that the Mississippi and Missouri Rivers and the Gulf of Mexico are valuable resources and hopes that the Sierra Club and other stakeholders will actively participate in this effort to help ensure success.

Since EPA's current criteria recommendations may not be appropriate to promulgate for the Mississippi and Missouri Rivers, EPA intends to convene a national workshop that will initiate discussions on a collaborative approach to determining the appropriate ambient water quality nutrient criteria for the Mississippi and Missouri Rivers (taking into account the effects on the Gulf of Mexico). In order for EPA to promulgate nutrient criteria for the petition area based on sound science, EPA must first address the scientific uncertainties that remain regarding ambient water quality criteria for nutrients for the Mississippi and Missouri Rivers. In the interim, however, the states are actively working with EPA to develop and adopt quantitative nutrient criteria for tributaries to these rivers that will lead to an overall reduction of nutrients within the basin. Therefore, in the absence of scientifically sound criteria appropriate for these rivers, EPA concludes that it is unnecessary for EPA to federally promulgate numeric nutrient criteria for the petition area, at this time, to meet the requirements of the CWA under CWA section 303(c)(4)(B).

h) Sediments

In section IV of the petition titled "Existing water quality standards for the Mississippi and Missouri Rivers in the Petition area are inadequate", the Sierra Club discusses the January 2003 GAO report stating that EPA has not yet developed national numeric criteria for sedimentation despite the fact that "sediments, nutrients and pathogens (including *E. coli* and enterococci) - account for fifty percent [sic] of the impaired waters nationwide,". Neither the petition nor the addenda to the petition discuss any specific issues of concern related to numeric sedimentation criteria in the petition area. In the absence of any information from the petitioner, EPA evaluated the petition states' currently approved water quality standards to determine if they are inconsistent with the CWA and federal regulations at 40 C.F.R. Part 131 such that a federal promulgation of numeric sedimentation criteria is necessary. EPA first looked to see whether any states have adopted numeric and/or narrative criteria related to sedimentation to protect designated uses. Then EPA evaluated the scientific understanding about sedimentation and designated uses to determine if the science is sufficient at this time to support EPA or state development of ambient water quality criteria.

All eight of the petition states currently have narrative criteria related to sedimentation that may be used for establishing NPDES permit limits, listing waters as impaired by sediments on section 303(d) impaired waters lists, and developing TMDLs, if necessary. Arkansas applies a numeric criterion for turbidity to the petition area.

EPA has not yet published numeric criteria recommendations under section 304(a) of the CWA for sediments (suspended and bedded sediments (i.e. sediments accumulated on the bottom of a stream bed)) because the science is not yet fully understood regarding how to appropriately establish criteria for sedimentation in surface waters. As part of the Water Quality Standards and Criteria Strategy, finalized in August 2003 (see EPA's website at http://www.epa.gov/waterscience/standards/strategy/), EPA committed to developing a Suspended and Bedded Sediment Criteria Strategy after consulting with EPA's Science Advisory Board. This strategy will inform EPA's development of guidance on controlling excess sediments. The suspended and bedded sediment strategy is expected to identify methods for developing numeric suspended and bedded sediment criteria and lead to recommendations that states can use to adopt their own numeric criteria for suspended and bedded sediments. These recommendations will also provide a benchmark for EPA to evaluate the effectiveness of state water quality standards programs. Since the Agency is currently developing a Suspended and Bedded Sediment Criteria Strategy to inform EPA's criteria recommendations for suspended and bedded sediment criteria and all the petition states have narrative criteria to provide a basis for controlling suspended and bedded sediments in the interim, if necessary, EPA concludes that it is unnecessary for the Administrator to federally promulgate numeric sedimentation criteria for the petition states, at this time, to meet the requirements of the CWA under CWA section 303(c)(4)(B), at this time. However, once EPA has published section 304(a) criteria recommendations for suspended and bedded sediments and has provided states appropriate time to incorporate the latest science into water quality standards, EPA will reevaluate the need for the Administrator to determine that a federal promulgation of numeric suspended and bedded sediment criteria is necessary to meet the requirements of the CWA.

i) IBI

Neither the petition nor the addenda to the petition discuss any specific concerns related to an index of biological integrity (IBI) in the petition area beyond their request that EPA publish numeric criteria. An index of biological integrity adopted as a water quality criterion in water quality standards is known as "biocriteria". EPA does not require that states adopt biocriteria into water quality standards to protect designated uses, however EPA believes that biocriteria and bioassessments are desired elements of a robust water quality program, which help to achieve the objectives of the CWA under section 101(a).

The CWA section 304(a)(8) provides that EPA shall publish "…methods for establishing and measuring water quality criteria for toxic pollutants on other bases than pollutant-by-pollutant criteria, including biological monitoring and assessment methods." Since numeric biocriteria (response criteria based on water body condition) must be developed on a regional or water body-specific basis using bioassessment monitoring data gathered from those water bodies, EPA does not publish national recommended biocriteria. Instead, states use EPA's recommended methods to develop and adopt biocriteria to protect their designated uses, as needed.

EPA has published biocriteria methods for streams, small rivers, lakes, reservoirs, wetlands, and estuaries and continues to develop methods for all other water body types. (see http://www.epa.gov/waterscience/biocriteria/). EPA's 10 Regional Offices have developed biocriteria implementation strategies for their individual states and the Agency provides technical support through grants, contracts and training. As of 2001, all states and some Tribes and territories had bioassessment programs for streams and small rivers and most are in the process of developing quantitative biocriteria. In the petition area, Nebraska and Missouri have adopted narrative biocriteria into water quality standards. Arkansas, Kentucky, and Tennessee have adopted narrative biocriteria into water quality standards and have also developed a quantitative implementation procedure or translator to interpret this narrative for wadeable streams. Missouri is currently working to develop a procedure for wadeable streams to interpret their narrative, while Iowa is actively working to develop narrative and numeric biocriteria for wadeable streams.[45] Since EPA has not yet provided biocriteria methods for large rivers, it is unlikely that the procedures adopted by the petition states are applicable to the Mississippi and Missouri Rivers. However, it is clear the states are making substantial progress toward developing and adopting biocriteria for other water bodies, statewide. Further, CWA section 106(e)(1) includes biological monitoring in the description of a monitoring program necessary to receive a grant from the Administrator. Since 40 C.F.R. §130.7(b)(5) requires states to "assemble and evaluate all existing and readily available water quality-related data and information," any available biological information will continue to be a part of the state assessment process.

While EPA has not yet developed biocriteria methods for large rivers, EPA is developing large river indicators of biological and physical habitat condition to help states and tribes assess the water quality conditions and identify impairments in large rivers. Two guidance manuals have been produced to date. One of these manuals details the differences between the methods used by various agencies to assess small and large rivers in the U.S. (see http://www.epa.gov/nerleerd/MCD_nocover.pdf); the second manual is a logistical guide for conducting ecological assessments in large rivers (http://www.epa.gov/nerleerd/logistics_nocover.pdf). New methods specifically designed to adequately sample large rivers are being tested currently. The results from this research will provide additional information to enable states and tribes to make informed decisions about the selection of scientifically robust and efficient methods to assess the biological conditions of large rivers using various relevant endpoints.

EPA is promoting state collection of biological data in large rivers in several other ways. For example, two classes addressing large river bioassessment and monitoring were taught at the first National Biocriteria Workshop at Coeur d'Alene, Idaho in 2003. The workshop was very well attended by states, including those along the Mississippi and Missouri Rivers. In addition, EPA scientists are working with the Kentucky Department of Natural Resources (DNR) in their implementation of the large river monitoring component of a Conservation Reserve Enhancement Program (CREP). This work is serving as the first step in Kentucky DNR's effort to initiate a state-wide large river bioassessment and monitoring program, and it may serve as an

[45] U.S. Environmental Protection Agency. *States and Tribes Embrace Bioassessment and Biocriteria for Protecting Streams and Small Rivers*. EPA - 822-F-03-005. June 2003.

example for other states to follow. Also, a team of scientists composed of national and regional large river experts is using the findings of completed research to develop a scientifically sound and logistically feasible large river bioassessment program for the Mississippi DNR.

For the reasons discussed above, EPA concludes that it is unnecessary for EPA to federally promulgate water quality standards that include an index of biological integrity for the petition area to meet the requirements of the CWA under CWA section 303(c)(4)(B). However, EPA believes that biocriteria and biomonitoring are important tools to support the state water quality programs and will continue to work with and encourage states to incorporate biological conditions/criteria into state water quality programs.

3) Monitoring

Petitioner's Position – The Sierra Club believes that limited and inconsistent water quality monitoring by states in the petition area is "a weak link in this system." Petition at 17. They assert that most of the states in the petition area do not routinely monitor water quality and that very little funding is devoted to ambient water quality monitoring. The Sierra Club also asserts that state monitoring approaches and methodologies lack consistency across the area leading to inconsistent and unreliable conclusions about waters meeting the applicable water quality standards, waters being listed as impaired under CWA section 303(d), and in identifying causes of impairment.   The petitioner requests that EPA promulgate water quality standards that include monitoring provisions to support uniform, statistically based method for determining whether the rivers are actually meeting applicable water quality standards.

EPA's Response – EPA denies the petitioner's request that EPA promulgate monitoring requirements as part of state water quality standards for the petition area. The "Statutory and Regulatory Background" section of this response describes the requirements for state water quality standards programs. Neither the CWA nor the implementing regulations require that water quality standards include monitoring provisions. EPA agrees with the petitioner that addressing shortcomings in state monitoring programs is a priority but believes that EPA's non-regulatory approaches planned and underway will achieve the outcome of strengthened and more consistent monitoring and assessment activity in the petition states.

<u>Background</u>

CWA section 305(b) requires a comprehensive biennial report on water quality and CWA section 303(d) requires states to assess waters and develop lists of impaired waters that do not meet water quality standards, even after point sources of pollution have installed the required levels of pollution control technology. States have flexibility to devise various approaches to assess waters and determine which waters are impaired and should be listed under section 303(d). EPA does not approve or disapprove a state's assessment and listing methodology but does approve or disapprove a state's section 303(d) list and may raise any issues about the state assessment methodology during this process. When developing the list of impaired waters, the CWA and EPA's implementing regulations require that states "…assemble and evaluate all existing and readily available water quality-related data and information." 40 C.F.R. §130.7(b)(5).

The CWA and implementing regulations confer broad latitude on states and provide for state flexibility in assigning priorities and employing different assessment and water quality management methods. Assessment and listing of interstate waters can pose challenges because of differences among methodologies and priorities in state water quality management programs. As the petition demonstrates, different state approaches on shared waterbodies can also create public concern and confusion. Major contributors to uncertainty about the water quality status of many waters, including shared waters, are gaps in monitoring and assessment.

EPA Efforts to Improve State Monitoring and Assessment Overall

Improving the rigor and consistency of state monitoring and assessment programs is a top priority for EPA because the Agency recognizes these programs are an essential foundation for effective water quality management. EPA is devoting substantial resources and attention to this issue. In fiscal year (FY) 2004, EPA received $4 million to improve our ability to answer questions about water quality on a national basis. The President's FY 2005 Budget Request seeks $20 million to help states and tribes develop and implement statistically representative water quality monitoring programs. A key objective of this effort is greater consistency in monitoring across state programs.

In addition, EPA issued *The Consolidated Assessment and Listing Methodology (CALM) (July 2002)*[46]. CALM provides a framework for states to document how they collect and use water quality data and information for environmental decision-making, in particular for determining whether waters are attaining water quality standards, identifying waters that are impaired and need to be included in the section 303(d) lists, and identifying waters that are meeting standards so that they can be removed from the list.

In March 2003, EPA provided guidance to states on the elements needed to strengthen state monitoring and assessment programs, *Elements of a State Water Monitoring and Assessment Program.*[47] The guidance calls for states to develop or commit to develop a Comprehensive State Monitoring Strategy in FY04. This strategy should be a long-term implementation plan for improving monitoring and assessment and emphasize a comprehensive approach to assessing all waterbody types over time through the use of multiple tools.

In a related effort, EPA is encouraging states to adopt a consistent format for categorizing and reporting the status of waters according to whether they have met water quality standards, require more data, or require a Total Maximum Daily Load (TMDL). This "integrated reporting" guidance emphasizes the importance for states to clearly articulate their methodology

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[46] U.S. Environmental Protection Agency. Consolidated and Assessment Listing Methodology.: Toward a Compendium of Best Practices. 2002. <http://www.epa.gov/owow/monitoring/calm.html>
[47] U.S. Environmental Protection Agency. Elements of a State Water Monitoring and Assessment Program. 2003. < http://www.epa.gov/owow/monitoring/elements/elements03_14_03.pdf> EPA 841-B-03-003.

for assessing waters and provide the public an opportunity to comment on both the methodology and proposed list of impaired waters. See *EPA's Guidance for 2004 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d) and 305(b) of the Clean Water Act, July 2003* (www.epa.gov/owow/tmdl/tmdl0103/index.html). The guidance also emphasizes that, where waters are shared among states, states should work together to collect, assemble, solicit, and assess all readily available data and information relevant to shared waters so that assessments are as consistent as possible. This coordination on shared waters is especially important for waters that are to be listed as impaired under CWA section 303(d) which then requires developing a TMDL.[48]

EPA expects that, through targeted funding and greater implementation of recent agency guidance, the quality and consistency of state monitoring and assessment programs will improve.

EPA and State Efforts to Improve Monitoring and Assessment in the Mississippi and Missouri Rivers

The challenge of improving water quality monitoring programs is even more daunting for large rivers such as the Mississippi and Missouri Rivers. The size and complexity of these rivers make representative data collection more difficult. Due to dilution in rivers of this size, localized water quality impairments may go undetected without intensive monitoring. Further, variability in river conditions means there is limited ability to extrapolate site-specific data where it does exist. To address the assessment challenges specific to large rivers, EPA's Office of Research and Development is preparing The Great Waters Initiative, a framework for state-based monitoring programs to assess the ecological condition of the Mississippi, Missouri and Ohio Rivers (see http://www.epa.gov/emap/greatriver/FactSheet.pdf). The framework is expected to include a probability-based design and indicators that could be used to assess the ecological condition of the three great rivers.

In the Upper Mississippi River basin, EPA Regions 5 and 7 are working directly with states to improve coordination on water quality management issues. The Upper Mississippi River Basin Association (UMRBA) is a regional interstate organization formed by the governors of Illinois, Iowa, Minnesota, Missouri, and Wisconsin to help coordinate the states' water quality issues related to the Mississippi River. UMRBA implemented a Water Quality Coordination Project that aimed to discern underlying reasons for state inconsistencies in assessment and listing and to initiate actions to address inconsistencies (www.umrba.org/wq/wq2002rpt.pdf). For example, one outcome of the project is a Memorandum of Understanding among the five UMRBA states to use a minimum number of common water reaches for purposes of characterizing water quality under CWA section 305(b) and identifying water quality impairments under section 303(d).

Over time, these efforts in the Upper Mississippi River basin should lead to improved consistency in state section 305(b) assessments and section 303(d) listings throughout Mississippi and Missouri basins. In addition to these ongoing efforts, EPA will work with the

[48] U.S. Environmental Protection Agency. 2003. *EPA's Guidance for 2004 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d) and 305(b) of the Clean Water Act, July 2003*. http://www.epa.gov/owow/monitoring/repguid.html).

petition states during the 2006 reporting and listing cycle (now underway) to resolve or explain, where possible, inconsistencies in the listing of impaired waters on the Mississippi and Missouri Rivers. Examples cited by the petitioner, including the fact that Arkansas and Kentucky did not include the Mississippi River on their 1998 section 303(d) list and that Kansas did not list the Missouri River in 1998, will be given particular consideration. EPA will continue through successive listing cycles to use any new sources of water quality data for the affected river segments, such as data generated through the Great Waters Initiative, to work with states in refining their impaired water lists. Therefore, EPA concludes it is unnecessary for EPA to federally promulgate monitoring requirements in water quality standards for the petition area to meet the requirements of the CWA under CWA section 303(c)(4)(B).

Conclusion

For the foregoing reasons, EPA denies the petition's request for EPA to publish water quality standards for the petition area, at this time.

ATTACHMENT A – WATER QUALITY STANDARDS FOR PETITION STATES: LIST AND CITATIONS

State	State Regulation Information
Arkansas	Arkansas Pollution Control and Ecology Commission; Regulation 2 - Regulation Establishing Water Quality Standards for Surface Waters of the State of Arkansas; (October 28, 2002); Effective under Clean Water Act - January 23, 2003. http://www.epa.gov/ost/standards/wqslibrary/ar/ar.html
Illinois	Title 35: Environmental Protection; Subtitle C: Water Pollution; Chapter 1: Pollution Control Board Parts 301 Introductions & Park 302 Water Quality Standards (August 26, 1999) http://www.epa.gov/ost/standards/wqslibrary/il/il.html
Iowa	567 Iowa Administrative Code Chapter 61 – Water Quality Standards Effective under Clean Water Act – June 16, 2004 http://www.epa.gov/ost/standards/wqslibrary/ia/ia.html
Kansas	Kansas Department of Health and Environment; Division of Environment; Bureau of Environmental Field Services Kansas Surface Water Register (December 15, 2003) Effective Under Clean Water Act–To be acted upon June 2004 Kansas Administrative Regulations Title 28, Article 16 – Surface Water Quality Standards (September 25, 2003) Effective Under the Clean Water Act – November 3, 2003 http://www.epa.gov/ost/standards/wqslibrary/ks/ks.html
Kentucky	Natural Resources and Environmental Protection Cabinet; Department for Environmental Protection; Division of Water Kentucky Administrative Regulations, Title 401, Chapter 5 Effective Under the Clean Water Act – December 8, 1999 http://www.epa.gov/ost/standards/wqslibrary/ky/ky.html
Missouri	Code of State Regulations Title 10 - Rules of Department of Natural Resources; Division 20 – Clean Water Commission; Chapter 7 – Water Quality 10 CSR 20-7 (10/31/99) http://www.epa.gov/ost/standards/wqslibrary/mo/mo.html
Nebraska	Nebraska Department of Environmental Quality Title 117 – Nebraska Surface Water Quality Standards (12/31/02) Effective Under the Clean Water Act – August 8, 2003 http://www.epa.gov/ost/standards/wqslibrary/ne/ne.html
Tennessee	Rules of the Tennessee Department of Environment and Conservation; Division of Water Pollution Control Chapter 1200-4-3 General Water Quality Criteria (October 1999) Effective Under the Clean Water Act – October 11, 1999 http://www.epa.gov/ost/standards/wqslibrary/tn/tn.html

Attachment B -- EPA analysis of State Water Quality Standards in the Petition Area
(Mississippi River)

NOTE: ***Spreadsheet reflects applicable numeric criteria only.***
Numeric criteria reflected are most stringent criteria applicable to segment.

STATE	DESIGNATED USE												NUMERIC WATER QUALITY CRITERIA									
EPA's most recent 304(a) recommendations next to pollutant label	**Outstanding State Resource Water**	**Primary Rec**	**Secondary Rec**	**Aquatic Life**	**Aesthetics**	**Fish Consumption**	**Drinking Water/Domestic Water Supply**	**Agriculture**	**Irrigation**	**Livestock & Wildlife watering**	**Naviagation**	**Industrial**	**chlordane (CCC = .0043 µg/l, water + organism = .00080 µg/l, organism only = .00081 µg/l) MCL=.002mg/L or 2 µg/l**	**atrazine 1500 µg/l freshwater, 760 µg/l saltwater, MCL = 3 ppb or 3 µg/l**	**Total PCBs (CCC = .014 µg/l, HH = .000064 µg/l updated) MCL = .5 ppb or .5 µg/l**	**e.coli (126 / 100 ml)**	**enterococci (33 per 100 ml)**	**DO (5 mg/l 1 day minimum)**	**Ammonia (1999 update, pH/temp. dependent)**	**Phosphorus (ecoregional based)**	**Nitrogen (ecoregional based)**	**Sediments (narrative. Sedimentation criteria in development)**
IA (effective 6/16/04)																						
Skunk River to Iowa River		X		Significant Resource Warm Water (Class B(WW))				X	X	X		X	C = .004 µg/l* A = 2.5 µg/l* HH (fish consumption) = .006 µg/l *		C = .014 µg/l * A = 2 µg/l * HH (fish consumption) = .0004 µg/l *	E. coli = 126/100 ml* (geometric) Mar 15 - Nov 15, 235/100 ml* (single sample max)		no less than 5 mg/l (at any time)				Turbidity shall not be increased by more than 25 NTU by any point source discharge
IA-MO state line to confluence w/ Skunk R.		X		Significant Resource Warm Water (Class B(WW))				X	X	X		X	C = .004 µg/l* A = 2.5 µg/l* HH (fish consumption) = .006 µg/l *		C = .014 µg/l * A = 2 µg/l * HH (fish consumption) = .0004 µg/l *	E. coli = 126/100 ml* (geometric) Mar 15 - Nov 15, 235/100 ml* (single sample max)		no less than 5 mg/l (at any time)				Turbidity shall not be increased by more than 25 NTU by any point source discharge
Burlington Water works							X	X	X	X		X	PWS = .021 µg/l *	PWS = 3 µg/l *	PWS = .0017 µg/l*						Nitrate as N = 10 mg/l Nitrate + Nitrite as N = 10 mg/l Nitrite as N = 1 mg/l	Turbidity shall not be increased by more than 25 NTU by any point source discharge
Koekuk Municipal Water Works Intake							X	X	X	X		X	PWS = .021 µg/l *	PWS = 3 µg/l *	PWS = .0017 µg/l*						Nitrate as N = 10 mg/l Nitrate + Nitrite as N = 10 mg/l Nitrite as N = 1 mg/l	Turbidity shall not be increased by more than 25 NTU by any point source discharge
Fort Madison Municipal Water Works Intake							X	X	X	X		X	PWS = .021 µg/l *	PWS = 3 µg/l *	PWS = .0017 µg/l*						Nitrate as N = 10 mg/l Nitrate + Nitrite as N = 10 mg/l Nitrite as N = 1 mg/l	Turbidity shall not be increased by more than 25 NTU by any point source discharge
IL(effective 8/26/99)	Designated General Use Water (protects for multiple uses)																					
Mississippi River		X^	X	X	X			X		X		X	Narrative w/Translator A = 2.4 µg/l C = .0043 µg/l noncancer = .72 ng/l	A = 280 µg/l ## C = 12 µg/l ##	HH = .015 ng/L	Fecal = 200 (geometric)* nor 400* in 10% of 30 day samples		no less than 5 mg/l (at any time) or less than 6 mg/l 16 of 24 hours		.05 mg/l* in reservoir/lake 8.1 hectares (or entering stream)		
Mississippi R. at Drinking Water/Food Processing Intakes		X^	X	X	X		Public and Food Processing Water Supply	X		X		X	.003 mg/l*	A = 280 µg/l ## C = 12 µg/l ##	HH = .015 ng/L (fish consumption only)	Fecal = 2000 (geometric)*		no less than 5 mg/l (at any time) or less than 6 mg/l 16 of 24 hours		.05 mg/l* in reservoir/lake 8.1 hectares (or entering stream)	Nitrate-Nitrogen = 10 mg/l*	
MO (effective 10/31/99)																						
State Line to Ohio R.			X	WW & HH fish consumption		X	X		X	X		X	HH (fish consumption) = .00048 µg/l* PWS = 2 µg/l*	PWS = 3 µg/l*	HH = .000045 µg/l*			5 mg/l (no less than)			PWS Nitrate-Nitrogen = 10 mg/L	
Ohio R. to Missouri R.			X	WW & HH fish consumption		X	X		X	X		X	HH (fish consumption) = .00048 µg/l* PWS = 2 µg/l*	PWS = 3 µg/l*	HH = .000045 µg/l*			5 mg/l (no less than)			PWS Nitrate-Nitrogen = 10 mg/L	
Missouri R. to Des Moines R.		X	X	WW & HH fish consumption		X	X			X		X	HH (fish consumption) = .00048 µg/l* PWS = 2 µg/l*	PWS = 3 µg/l*	HH = .000045 µg/l*	Fecal = 200*		5 mg/l (no less than)			PWS Nitrate-Nitrogen = 10 mg/L	
KY (12/8/99)																						
Mississippi R. - Confluence w/ Ohio R. to River Mile 947.0		X	X	Warm Water Aquatic Habitat									(Proposing to adopt 2002 EPA HH recommendations) C = .0043 µg/l* A = 2.4 µg/l* HH (fish consumption) = 0.0022 µg/l*		C = .0014µg/l* A = LC1* or 1/3 LC50* or .3 acute toxicity units* HH (fish consumption) = .000079 µg/l*	Fecal = 200 (geometric, not less than 5 samples/month)* nor <400* in more 20% or more of all samples in month		Daily average = 5.0 mg/l (no less than)** Minimum = 4.0 mg/l(no less than)*	un-ionized = 0.05 mg/l*			
Mississippi R. - River mile 947.0 to 945.0	X	X	X	Warm Water Aquatic Habitat									"		"	"	"	"	"			
Mississippi R. - River mile 945.0 to KY/TN state line		X	X	Warm Water Aquatic Habitat									"		"	"	"	"	"			

Attachment B -- EPA analysis of State Water Quality Standards in the Petition Area
(Mississippi River)

STATE		DESIGNATED USE											NUMERIC WATER QUALITY CRITERIA										
EPA's most recent 304(a) recommendations next to pollutant label	**Outstanding State Resource Water**	**Primary Rec**	**Secondary Rec**	**Aquatic Life**	**Aesthetics**	**Fish Consumption**	**Drinking Water/Domestic Water Supply**	**Agriculture**	**Irrigation**	**Livestock & Wildlife watering**	**Naviagation**	**Industrial**	**chlordane (CCC = .0043 µg/l, water + organism = .00080 µg/l, organism only = .00081 µg/l) MCL=.002mg/L or 2 µg/l**	**atrazine 1500 µg/l freshwater, 760 µg/l saltwater, MCL = 3 ppb or 3 µg/l**	**Total PCBs (CCC = .014 µg/l, HH = .000064 µg/l updated) MCL = .5 ppb or .5 µg/l**	**e.coli (126 / 100 ml)**	**enterococci (33 per 100 ml)**	**DO (5 mg/l 1 day minimum)**	**Ammonia (1999 update, pH/temp. dependent)**	**Phosphorus (ecoregional based)**	**Nitrogen (ecoregional based)**	**Sediments (narrative, Sedimentation criteria in development)**
AR (effective 1/23/03)																						
Mississippi River		X	X	Perrenial Delta Fishery			X		X			X	C = .0043 µg/l** A = 2.4 µg/l* HH = 5 ng/l		C = .0140 µg/l** HH = .4 ng/l	fecal = 200* (geometric) nor 400* in more than 10% of 30 day samples		5 mg/l (no less than)		TP = 100 µg/l***	10 mg/l effluent limit for dischargers near domestic water supply uses #	Turbidity = 50 NTU
TN (effective 10//11/99)																						
Mississippi R. Mile 741.0 to 820.0		X		X			X		X	X	X	X	(Adopted 2002 EPA HH recommendations, pending approval) C = .0043 µg/l A = 2.4 µg/l 2 µg/l* (PWS) water+organism = .0057 µg/l, organism only = .0059 µg/l	3 µg/l* (PWS)	C = .014 µg/l (each aroclor) 0.5 µg/l* (PWS) water+organism = .00044 µg/l total, organism only = .00045 µg/l total	Fecal = 200* , E.coli = 126 *(geometric based on 10 samples)		5 mg/l (no less than)				
Mississippi R. Mile 820.0 to TN/KY state line (Mile 905.0)		X		X			X		X	X	X	X	(Adopted 2002 EPA HH recommendations, pending approval) C = .0043 µg/l A = 2.4 µg/l 2 µg/l* (PWS) water+organism = .0057 µg/l, organism only = .0059 µg/l	3 µg/l* (PWS)	C = .014 µg/l (each aroclor) 0.5 µg/l* (PWS) water+organism = .00044 µg/l , organism only = .00045 µg/l	Fecal = 200* , E.coli = 126 *(geometric based on 10 samples)		5 mg/l (no less than)				

* Shall not exceed
** 24 hour average
*** As a guideline, shall not exceed
^Protects for Primary "for all General Use waters whose physical configuration permits
Based on Arkansas Water Quality Planning and Management: State Continuing Planning Process (1999)
Based on Narrative Procedure to derive Numeric Criteria

Attachment B -- EPA Analysis of State Water Quality Standards in the Petition Area
(Missouri River)

NOTE: ***Spreadsheet reflects applicable numeric criteria only.***
Numeric criteria reflected are most stringent criteria applicable to segment.

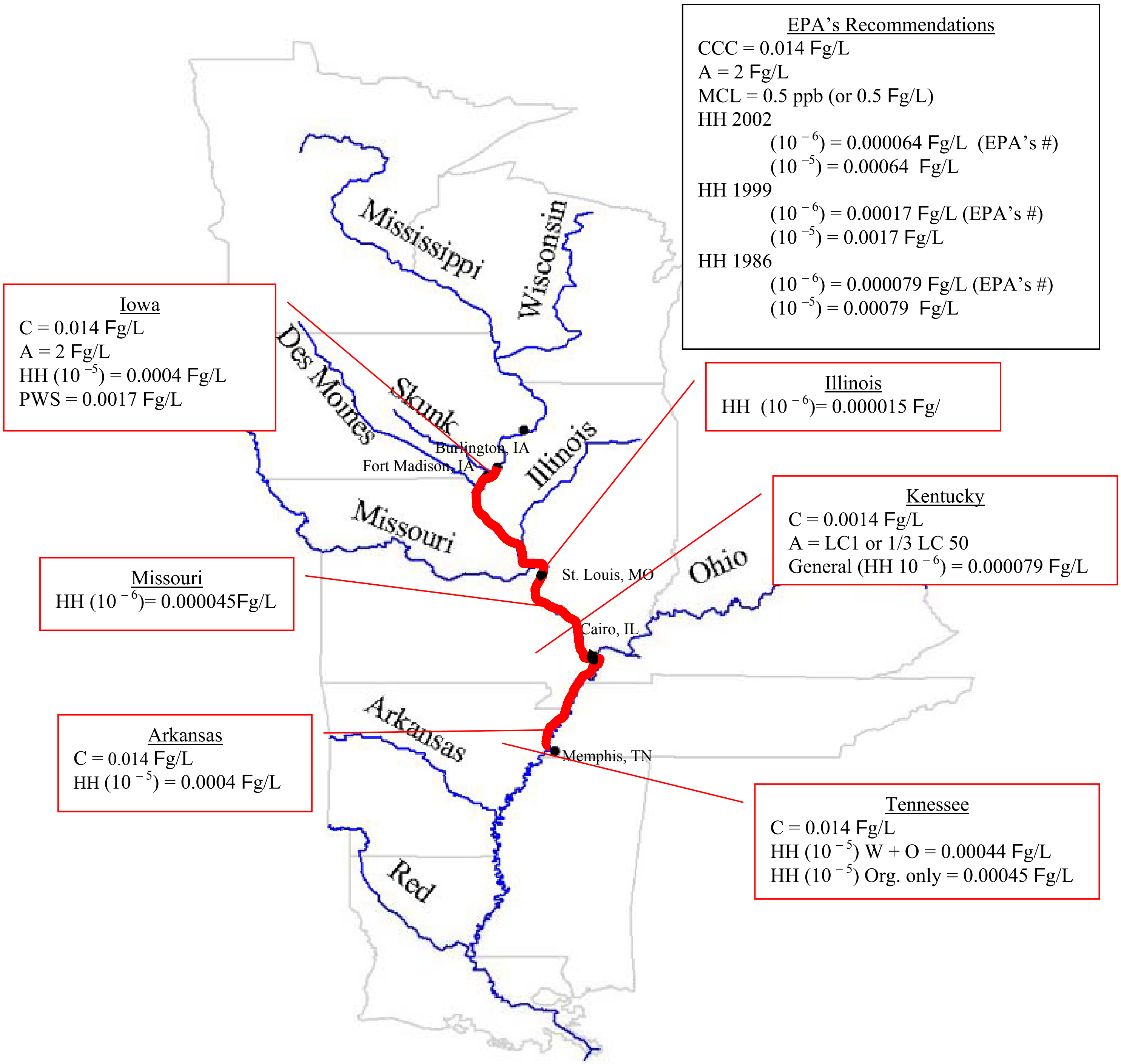
STATE	DESIGNATED USE										NUMERIC WATER QUALITY CRITERIA									
	Primary Rec	Secondary Rec	Aquatic Life	Aesthetics	Food Procurement/ Fish consumption	Public/Domestic Water Supply	Agricultural	Irrigation	Livestock & Wildlife watering	Industrial	chlordane (CCC = .0043 µg/l, water + organism = .00080 µg/l, organism only = .00081 µg/l) MCL=.002mg/L or 2 µg/l	atrazine 1500 µg/l freshwater, 760 µg/l saltwater, MCL = 3 ppb or 3 µg/l	Total PCBs (CCC = .014 µg/l, CMC = 2 µg/l, HH = .000064 µg/l updated) MCL = .5 ppb or .5 µg/l	e.coli (126 per 100 ml)	enterococci (33 per 100 ml)	DO (5 mg/l 1 day minimum)	Ammonia (1999 update, pH/temp. dependent)	Phosphorus (ecoregional based)	Nitrogen (ecoregional based)	Sediments (narrative. Sedimentation criteria in development)
IA (effective 6/16/04)																				
IA-MO state line to confluence w/ Big Sioux R.	X		Significant Resource Warm Water (Class B(WW))				X	X	X	X	C = .004 µg/l * A = 2.5 µg/l* HH = .006 µg/l*		C = .014 µg/l* A = 2 µg/l* HH = .0004 µg/l*	E. coli = 126/100 ml* (geometric) Mar 15 - Nov 15, 235/100 ml* (single sample max)		no less than 5 mg/l (at any time)				Turbidity shall not be increased by more than 25 NTU by any point source discharge
City of Council Bluffs Water Works Intake						X	X	X	X	X	PWS = .021 µg/l*	PWS = 3µg/l*	PWS = .0017µg/l*						Nitrate as N = 10 mg/l Nitrate + Nitrite as N = 10 mg/l Nitrite as N = 1 mg/l	Turbidity shall not be increased by more than 25 NTU by any point source discharge
NE (effective 8/8/03)	Water quality criteria to protect downstream beneficial uses shall be applicable to all surface waters, whether or not those beneficial uses are assigned to a given water body.																			
Platte R. to NE-KS border	X		Class A Warm Water	X		X	X			X	C = .0043 µg/l** A = 2.4 µg/l* PWS = 2 µg/l*	C = 12 µg/l (4 day average) A = 330 µg/l (1 hr average) PWS = 3 µg/l*	C = .0017 µg/l** A = 2 µg/l* PWS = .5 µg/l*	fecal = 200 (geometric mean)* or 400 (no more than 10% of samples shall equal or exceed) E.coli = 126/100ml* (5 samples, 30-day period)		1 day min no less than 5 mg/l (April 1 - Sep. 30 - early life stages) 1 day min no less than 3 mg/l (Oct. 1 - Mar. 31)			(AG) Nitrate + Nitrite = 100 mg/l* (PWS) Nitrate-nitrogen = 10 mg/L* (PWS) Nitrite-Nitrogen = 1 mg/L*	
Big Sioux R. to Platte R.	X		Class A Warm Water	X		X	X			X	C = .0043 µg/l** A = 2.4 µg/l* PWS = 2 µg/l*	C = 12 µg/l (4 day average) A = 330 µg/l (1 hr average) PWS = 3 µg/l*	C = .0017 µg/l** A = 2 µg/l* PWS = .5 µg/l*	fecal = 200 (geometric mean)* or 400 (no more than 10% of samples shall equal or exceed) E.coli = 126/100ml* (5 samples, 30-day period)		1 day min no less than 5 mg/l (April 1 - Sep. 30 - early life stages) 1 day min no less than 3 mg/l (Oct. 1 - Mar. 31)			(AG) Nitrate + Nitrite = 100 mg/l* (PWS) Nitrate-nitrogen = 10 mg/L* (PWS) Nitrite-Nitrogen = 1 mg/L*	
MO (10/31/99)																				
Mouth to Gasconade R.		X	WW & HH fish consumption			X		X	X	X	HH = .00048 µg/l* PWS = 2 µg/l*	PWS = 3 µg/l*	C = .000045 µg/l*			5 mg/l (no less than)			PWS Nitrate-Nitrogen = 10 mg/L	
Gasconade R. to Chariton R.		X	WW & HH fish consumption			X		X	X	X	HH = .00048 µg/l* PWS = 2 µg/l*	PWS = 3 µg/l*	C = .000045 µg/l*			5 mg/l (no less than)			PWS Nitrate-Nitrogen = 10 mg/L	
Chariton R. to Kansas R.		X	WW & HH fish consumption			X		X	X	X	HH = .00048 µg/l* PWS = 2 µg/l*	PWS = 3 µg/l*	C = .000045 µg/l*			5 mg/l (no less than)			PWS Nitrate-Nitrogen = 10 mg/L	
Kansas R. to State Line		X	WW & HH fish consumption			X		X	X	X	HH = .00048 µg/l* PWS = 2 µg/l*	PWS = 3 µg/l*	C = .000045 µg/l*			5 mg/l (no less than)			PWS Nitrate-Nitrogen = 10 mg/L	

Attachment B -- EPA Analysis of State Water Quality Standards in the Petition Area
(Missouri River)

STATE	DESIGNATED USE										NUMERIC WATER QUALITY CRITERIA									
	Primary Rec	Secondary Rec	Aquatic Life	Aesthetics	Food Procurement/ Fish consumption	Public/Domestic Water Supply	Agricultural	Irrigation	Livestock & Wildlife watering	Industrial	chlordane (CCC = .0043 µg/l, water + organism = .00080 µg/l, organism only = .00081 µg/l) MCL=.002mg/L or 2 µg/l	atrazine 1500 µg/l freshwater, 760 µg/l saltwater, MCL = 3 ppb or 3 µg/l	Total PCBs (CCC = .014 µg/l, CMC = 2 µg/l, HH = .000064 µg/l updated) MCL = .5 ppb or .5 µg/l	e.coli (126 per 100 ml)	enterococci (33 per 100 ml)	DO (5 mg/l 1 day minimum)	Ammonia (1999 update, pH/temp. dependent)	Phosphorus (ecoregional based)	Nitrogen (ecoregional based)	Sediments (narrative. Sedimentation criteria in development)
KS (effective 11/3/03)																				
Missouri R. (HUC 10240005, Seg. 1)	Class B	X	Special Aquatic Life Use (applicable criteria same for all aquatic life use designations. Only use name differs)		X	X		X	X	X	C = .0043 µg/l* A = 2.4 µg/l* HH (fish consumption) = .00048 µg/l* (3 µg/l for LWW) PWS = .00057 µg/l (EPA)	C = 3 µg/l* A = 170 µg/l* PWS = 3 µg/l*	C = .014 µg/l* A = 2 µg/l* HH (fish consumption) = .0000079 µg/l* PWS = .00017 µg/l (EPA)	E.coli (geometric mean)* = 262/100 mL		not less than 5 mg/l		Elemental P = .1 µg/l	Nitrate as N = 10 mg/l (PWS) Nitrite + Nitrate as N = 10 mg/l (PWS) or 100 mg/l (LWW)	
Missouri R. (HUC 10240005, Seg. 19)	"	X	Special Aquatic Life Use		X	X		X	X	X	"	"	"	"	"	"		"	"	
Missouri R. (HUC 10240005, Seg. 2)	"	X	Special Aquatic Life Use		X	X		X	X	X	"	"	"	"	"	"		"	"	
Missouri R. (HUC 10240005, Seg. 21)	"	X	Special Aquatic Life Use		X	X		X	X	X	"	"	"	"	"	"		"	"	
Missouri R. (HUC 10240011, Seg. 1)	"	X	Special Aquatic Life Use		X	X		X	X	X	"	"	"	"	"	"		"	"	
Missouri R. (HUC 10240011, Seg. 11)	"	X	Special Aquatic Life Use		X	X		X	X	X	"	"	"	"	"	"		"	"	
Missouri R. (HUC 10240011, Seg. 13)	"	X	Special Aquatic Life Use		X	X		X	X	X	"	"	"	"	"	"		"	"	
Missouri R. (HUC 10240011, Seg. 15)	"	X	Special Aquatic Life Use		X	X		X	X	X	"	"	"	"	"	"		"	"	
Missouri R. (HUC 10240011, Seg. 19)	"	X	Special Aquatic Life Use		X	X		X	X	X	"	"	"	"	"	"		"	"	
Missouri R. (HUC 10240011, Seg. 2)	"	X	Special Aquatic Life Use		X	X		X	X	X	"	"	"	"	"	"		"	"	
Missouri R. (HUC 10240011, Seg. 4)	"	X	Special Aquatic Life Use		X	X		X	X	X	"	"	"	"	"	"		"	"	
Missouri R. (HUC 10240011, Seg. 5)	"	X	Special Aquatic Life Use		X	X		X	X	X	"	"	"	"	"	"		"	"	
Missouri R. (HUC 10240011, Seg. 7)	"	X	Special Aquatic Life Use		X	X		X	X	X	"	"	"	"	"	"		"	"	
Missouri R. (HUC 10240011, Seg. 9)	"	X	Special Aquatic Life Use		X	X		X	X	X	"	"	"	"	"	"		"	"	
Missouri R. (HUC 10240011, Seg. 9099)	"	X	Expected Aquatic Life Use		X	X	X	X	X	X	"	"	"	"	"	"		"	"	

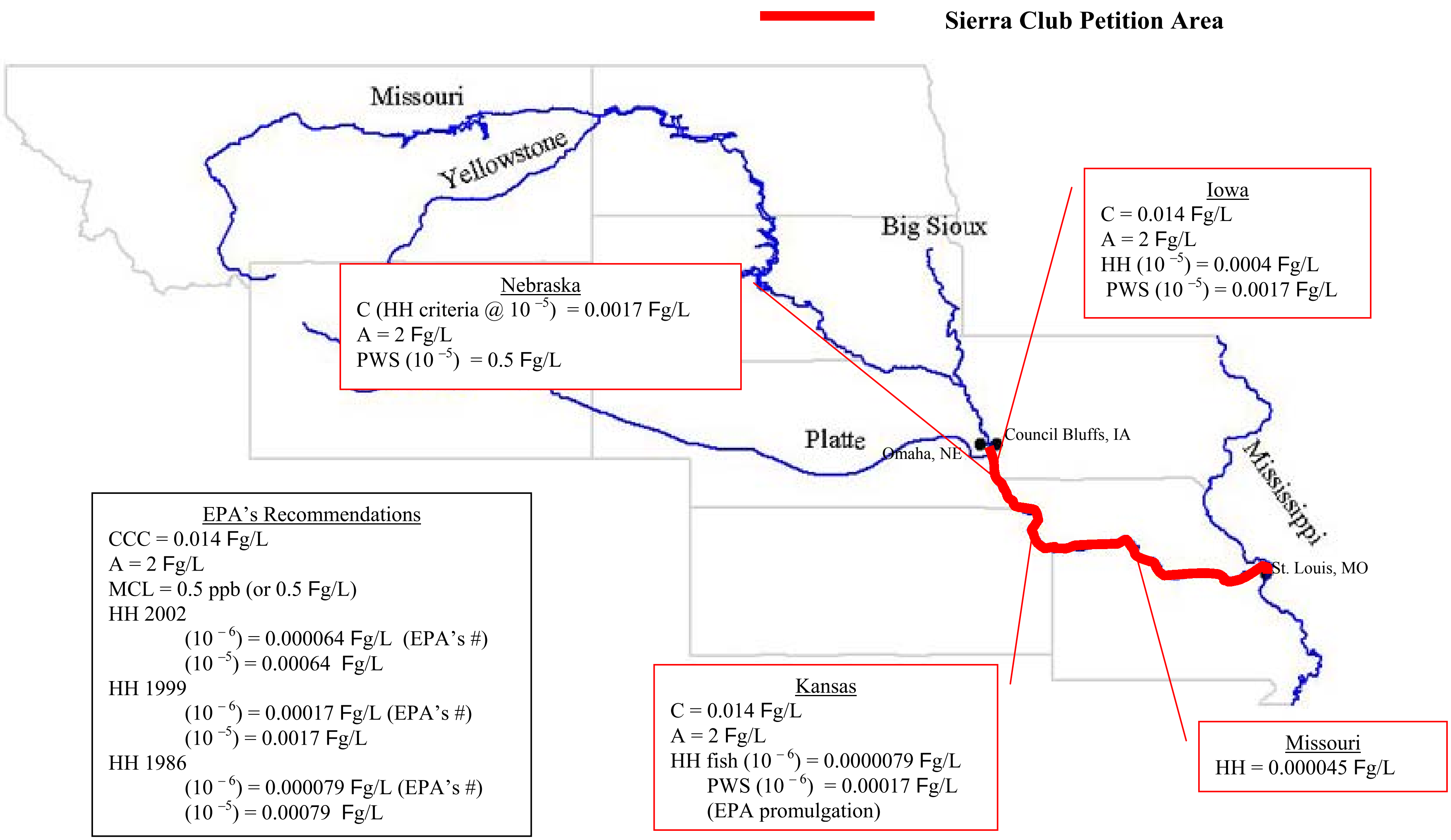
* Shall not exceed
** 24 hour average

ATTACHMENT C
PCB CRITERIA ON MISSISSIPPI RIVER

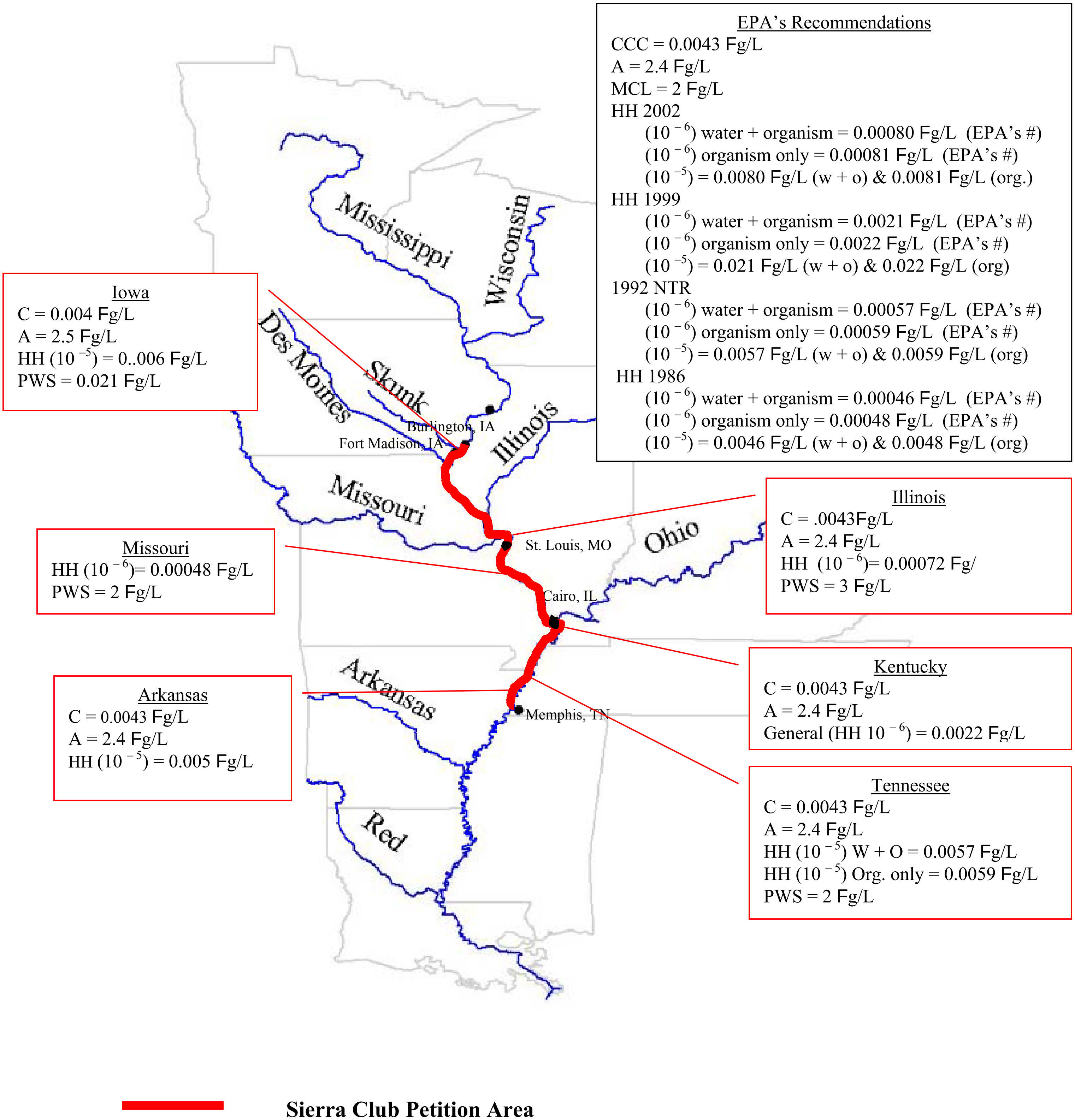


Sierra Club Petition Area

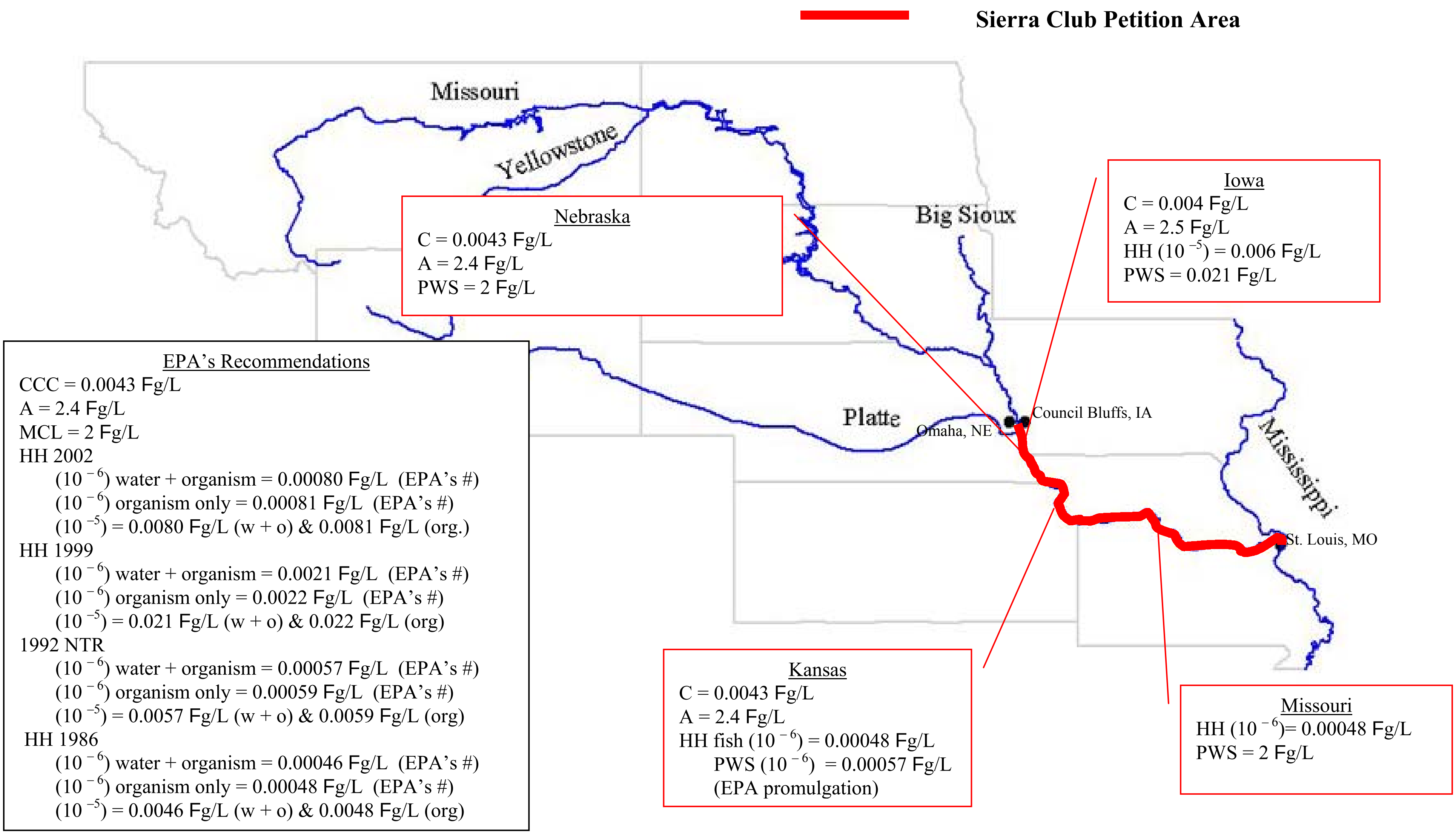
ATTACHMENT D
PCB CRITERIA ON MISSOURI RIVER



ATTACHMENT E
CHLORDANE CRITERIA ON MISSISSIPPI RIVER



ATTACHMENT F
CHLORDANE CRITERIA ON MISSOURI RIVER



ATTACHMENT G
PETITION STATES' CWA SECTION 303(D) IMPAIRED WATERS LISTINGS FOR MISSISSIPPI AND MISSOURI RIVER
(As Of March 2004)

Mississippi River

	Segment	Location	Impairment	Use impaired
Iowa				
	IA-1-NEM-0010_2	L&D 15 to L&D 14	arsenic	Drinking water
	IA01-NEM-0010_4	Wapsipinicon R. to L&D 13	organic enrichment	Aquatic life
	IA-03-SKM-0010_1	MO state line to outfall of Ft. Madison WWTP	arsenic	Drinking water
Illinois				
	ILI01_I 05	Mississippi River South	PCBs	Overall use, drinking water supply, fish consumption, aquatic life, primary contact (swimming)
	ILJ81_J 01		PCBs	Overall use, drinking water supply, fish consumption, aquatic life
	ILJ83_J 05		PCBs, Siltation, Suspended Solids, Metals, Nutrients, Phosphorus, Total Ammonia-N, Nitrates	Overall use, fish consumption, aquatic life, primary contact (swimming)
	ILJ83_J 06		PCB siltation, flow alterations, habitat, nutrients	Overall use, fish consumption, aquatic life

	Segment	Location	Impairment	Use impaired
	ILJ03_J 11		Nonpriority Organics, Siltation, Habitat Alteration, Suspended Solids, Priority Organics	Overall use, drinking water supply, fish consumption, aquatic life
	ILK04_K 22		PCBs, Pathogens, Organic Enrichment, Priority Organics	Overall u7se, drinking water supply, fish consumption, aquatic life, primary contact (swimming)
	ILK03_K 17		PCBs, Organic Enrichment, Priority Organics	Overall use, drinking water supply, fish consumption, aquatic life
	ILK06_K 21		PCBs, Organic Enrichment, Priority Organics	Overall use, fish consumption, aquatic life
	ILM02_M 06		PCBs	Overall use, fish consumption, aquatic life
	ILM03_M 03		PCBs	Overall use, fish consumption, aquatic life
	ILM04_M 04		PCBs	Overall use, fish consumption, aquatic life, primary contact (swimming)
	ILM05_M 05		PCBs	Overall use, drinking water supply, fish consumption, aquatic life

	Segment	Location	Impairment	Use impaired
	ILM10_M 10		PCBs	Overall use, fish consumption, aquatic life, primary contact (swimming)
	ILI84_I 84		PCBs	Overall use, fish consumption, aquatic life, primary contact (swimming)
Missouri				
	WBID 1707	Ohio R to Missouri R. @ Herculaneum (5 mi)	lead, zinc	Aquatic life
	WBID 3152	Ohio R. to state line	chlordane, PCBs	Aquatic life (fish consumption)
	WBID 1707	Missouri R. to Ohio R.	chlordane, PCBs	Aquatic life (fish consumption)
	WBID 1	Des Moines R. to Missouri R.	chlordane, PCBs	Aquatic life (fish consumption)
Kentucky	No 303(d) listings			
Tennessee				
	TN08010100001 - 0200	BLUE BANK BAYOU	Nutrients. siltation	Fish and aquatic life use
	TN08010100001 –1000	MISSISSIPPI RIVER	PCBs, dioxin, chlordane, nitrate, siltation, other habitat alterations	Fishing advisory originally due to chlordane

	Segment	Location	Impairment	Use impaired
	TN08010100001 - 1100	MCKELLAR LAKE	PCBs, chlordane, dioxin, siltation, organic enrichment/low DO, pathogens	Fishing advisory originally due to chlordane.
	TN08010100001 - 2000	MISSISSIPPI RIVER	PCBs, dioxin, chlordane, nitrate, siltation, other habitat alterations	Fish and aquatic life use.
	TN08010100001 - 3000	MISSISSIPPI RIVER	PCBs, dioxin, chlordane, nitrate, siltation, other habitat alterations	Fish and aquatic life use
	TN08010100001 - 4000	MISSISSIPPI RIVER	PCBs, dioxin, chlordane, nitrate, siltation, other habitat alterations	Documented habitat for a federally listed fish: the pallid sturgeon (Scaphirhynchus albus).
	TN08010100001 - 5000	MISSISSIPPI RIVER	PCBs, dioxin, chlordane, nitrate, siltation, other habitat alterations	Fish and aquatic life use.
	TN08010100POPLARTLK	POPLAR TREE LAKE	Nutrients	No recent data on this 125 acre lake.
Arkansas	No 303(d) listings			

Missouri River

	Segment	Location	Impairment	Use impaired
Iowa				
	IA06-WEM-0020_2	Council Bluffs water supply intake to Boyer R.	arsenic	Drinking water
	IA06-WEM-0020_2	Council Bluffs water supply intake to Boyer R.	bacteria	Primary contact recreation
Nebraska				
	MT1-10000	Big Sioux R. to Platte R.	fecal coliform	Primary contact recreation
	NE1-10000	Platte R. to Kansas border	fecal coliform	Primary contact recreation
Kansas	No 303(d) listings			
Missouri				
	WBID 1604	Gasconade R. to mouth	chlordane, PCBs	Aquatic life (fish consumption)
	WBID 701	Chariton R. to Gasconade R.	chlordane, PCBs	Aquatic life (fish consumption)
	WBID 356	Kansas R. to Chariton R.	chlordane, PCBs	Aquatic life (fish consumption)
	WBID 226	Iowa sate line to Kansas R.	chlordane, PCBs	Aquatic life (fish consumption)
	WBID 356	Kansas R. to Chariton R.	mercury	Aquatic life (fish consumption)
	WBID 226	Kansas R. to Iowa State line	mercury	Aquatic life (fish consumption)

FACT SHEET FOR NPDES PERMIT WA-0093317

Spokane County Regional Water Reclamation Facility (SCRWRF)

PURPOSE of this Fact Sheet

This fact sheet explains and documents the decisions Ecology made in drafting the proposed National Pollutant Discharge Elimination System (NPDES) Permit for the Spokane County Regional Water Reclamation Facility (SCRWRF).

This fact sheet complies with Section 173-220-060 of the Washington Administrative Code (WAC), which requires Ecology to prepare a draft permit *and accompanying fact sheet* for public evaluation before issuing an NPDES permit.

Ecology makes the draft permit and fact sheet available for public review and comment at least thirty (30) days before issuing the final permit. Copies of the fact sheet and draft permit for the Spokane County Regional Water Reclamation Facility NPDES Permit WA-0093317**,** are available for public review and comment from June 28, 2011 until August 29, 2011. For more details on preparing and filing comments about these documents, please see **Appendix A - Public Involvement**.

Spokane County Utilities and CH2M Hill reviewed the draft fact sheet for factual accuracy. Ecology corrected any errors or omissions regarding the facility's location, history, discharges, or receiving water.

After the public comment period closes, Ecology will summarize substantive comments and provide responses to them. Ecology will include the summary and responses to comments in this Fact Sheet as **Appendix E - Response to Comments**, and publish it when issuing the final NPDES Permit. Ecology will not revise the rest of the fact sheet, but the full document will become part of the legal history contained in the facility's permit file.

SUMMARY

The Spokane County Regional Water Reclamation Facility (SCRWRF) is an advanced wastewater treatment plant. It will provide an initial 8 million gallons per day (MGD) of capacity with an ability to expand capacity in phases up to 24 MGD. Spokane County owns and is financing the Facility. CH2M Hill Constructors, Inc. designed and built the facility, and will operate, maintain, and repair the Facility for an initial 20-year period. CH2M Hill Constructors, Inc. will be responsible for on-site biosolids treatment. The County constructed improvements to the conveyance system, including the force mains, pump stations and the outfall for the Facility, as separate public works projects. The Facility includes a treatment process incorporating a step-feed nitrification/denitrification membrane bioreactor with the following key components: fine screening, grit removal, primary clarification, sodium hypochlorite disinfection, gravity belt thickening for primary and waste activated sludge, anaerobic digestion, aerobic digestion/solid storage, centrifuge dewatering, and chemical feed systems. Other facilities include odor control, an administration building with a laboratory, a water resource center, and a maintenance building.

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I. INTRODUCTION

The Federal Clean Water Act (FCWA, 1972, and later amendments in 1977, 1981, and 1987) established water quality goals for the navigable (surface) waters of the United States. One mechanism for achieving the goals of the Clean Water Act is the National Pollutant Discharge Elimination System (NPDES), administered by the federal Environmental Protection Agency (EPA). The EPA authorized the State of Washington to manage the NPDES permit program in our state. Our state legislature accepted the delegation and assigned the power and duty for conducting NPDES permitting and enforcement to Ecology. The legislature defined Ecology's authority and obligations for the wastewater discharge permit program in 90.48 RCW (Revised Code of Washington).

The following regulations apply to municipal NPDES permits:

- Procedures Ecology follows for issuing NPDES permits (chapter 173-220 WAC)
- Technical criteria for discharges from municipal wastewater treatment facilities (chapter 173-221 WAC)
- Water quality criteria for surface waters (chapter 173-201A WAC) and for ground waters (chapter 173-200 WAC)
- Sediment management standards (chapter 173-204 WAC)
- Submission of Plans and Reports for Construction of Wastewater Facilities (Chapter 173-240 WAC)

These rules require any treatment facility operator to obtain an NPDES permit before discharging wastewater to state waters. They also help define the basis for limits on each discharge and for requirements imposed by the permit.

Under the NPDES permit program and in response to a complete and accepted permit application, Ecology must prepare a draft permit and accompanying fact sheet, and make them available for public review before final issuance. Ecology must also publish an announcement (public notice) telling people where they can read the draft permit, and where to send their comments, during a period of thirty days (WAC 173-220-050). (See **Appendix A - *Public Involvement*** for more detail about the public notice and comment procedures). After the public comment period ends, Ecology may make changes to the draft NPDES Permit. Ecology will summarize the responses to comments and any changes to the permit in **Appendix E.**

II. BACKGROUND INFORMATION

Table 1: General Facility Information

Applicant:	Spokane County Utilities
Facility Name and Address:	Spokane County Regional Water Reclamation Facility 1004 North Freya Street Spokane, WA 99202
Type of Treatment:	Step-feed nitrification/denitrification membrane bioreactor with chemical phosphorus removal and the following key components: fine screening, grit and scum removal, primary clarification, sodium hypochlorite disinfection, dechlorination, gravity belt thickening for primary and waste activated sludge, anaerobic digestion, aerobic digestion/solid storage, centrifuge dewatering, chemical feed systems and odor control systems.
Discharge Location:	Spokane River Latitude: 47.675833 N Longitude: -117.346944 W
Facility Contact:	John Keady, Operator 1004 N. Freya Street Spokane, WA 99202 (509) 536-3701
Responsible Official:	N. Bruce Rawls, P.E.; Utilities Director 1026 W. Broadway Spokane, WA 99260 (509) 477-3604

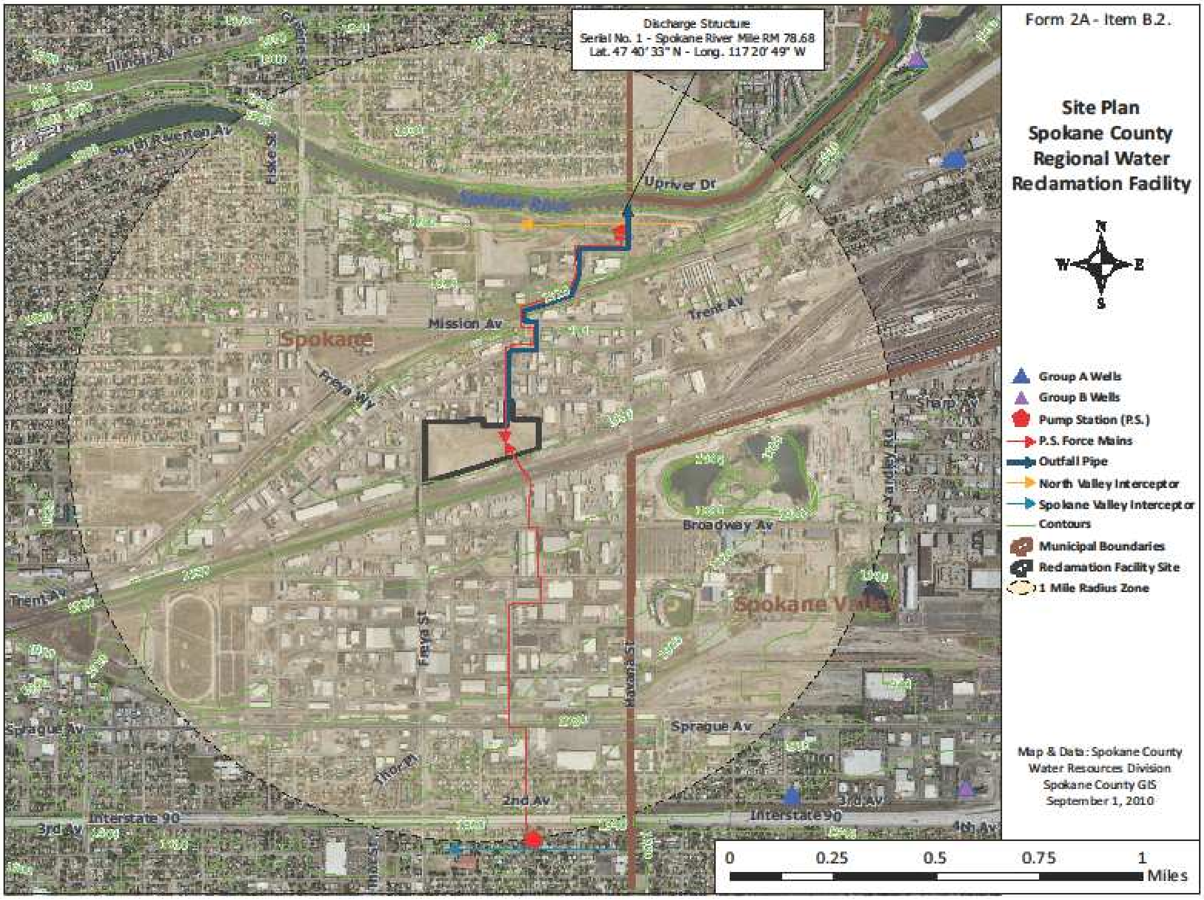


Figure 1: **Facility Location Map**

A. Facility Description

History

Sewer service by Spokane County Utilities began in the 1970's with studies to determine impacts of wastewater in the urbanizing portions of the county. The first comprehensive wastewater management plan was in 1981.

The County began a program in 1980 to eliminate septic tanks and connect customers to the County's sewer system to protect the Spokane Aquifer. Since the program began, over 38,000 customers have connected including approximately 25,000 septic tank conversions. This sewer expansion program is projected to continue through the year 2015 to provide wastewater service to all existing development within the County's sewer service area. By 2015, it is expected that approximately 9,000 additional existing septic tank customers will connect to the sewer system.

The planning area for Spokane County Utilities is divided into the 8,359-acre North Spokane section and the 31,103-acre Spokane Valley section (see Figures 2 & 3 Spokane County Utilities Service Area).
Two major interceptors further divide the Spokane Valley section into the "North Valley Service Area" and the "Spokane Valley Service Area."

Planning for the Spokane County Regional Water Reclamation Facility began with the 2001 Comprehensive Wastewater Management Plan. The construction is proceeding as a design build operate contract as authorized by Chapter 70.150 RCW Water Quality Joint Development Act.

The initial construction project is an 8 MGD water reclamation facility designed to meet the requirements of the Spokane River and Lake Spokane DO TMDL and more. The second phase will expand the facility to 12 MGD in approximately the year 2030. The County also owns 10 MGD of capacity at the City's Riverside Park Water Reclamation Facility (RPWRF), 6.5 MGD of which currently comes from the valley area. When the valley area growths and flows exceed 8 MGD, the excess will go the RPWRF until the phase 2 expansion is completed. The site has been laid out for incremental expansions to accommodate up to 24 MGD annual average flow.

Construction of the facility is proceeding with startup and testing commencing in August 2011 and a projected discharge to the Spokane River likely by December 2011.

Collection System Status

The collection system is relatively new and has been built principally of PVC pipe. The system's infiltration and inflow is minimal. It is also a separated system versus the combined storm water and sewerage system found in parts of the City of Spokane. Comparing current estimated population to measured flow, the gallons per capita per day (gpcd) is 80.5

The County collection system is connected to the City of Spokane interceptor system and Riverside Park Water Reclamation Facility. Wastewater that is not diverted to the Spokane County Regional Water Reclamation Facility will flow to the Riverside Park Water Reclamation Facility. Additionally, provisions have been made to allow effluent discharge from the Spokane County Regional Water Reclamation Facility to be routed back to the interceptor system and the Riverside Park Water Reclamation Facility. It is anticipated that this arrangement may be used during commissioning and startup of the Spokane County Regional Water Reclamation Facility. The County's North Spokane Interceptor also flows to the Riverside Park Water Reclamation Facility.

Figure 2: A Map of the County's North Spokane Service Area

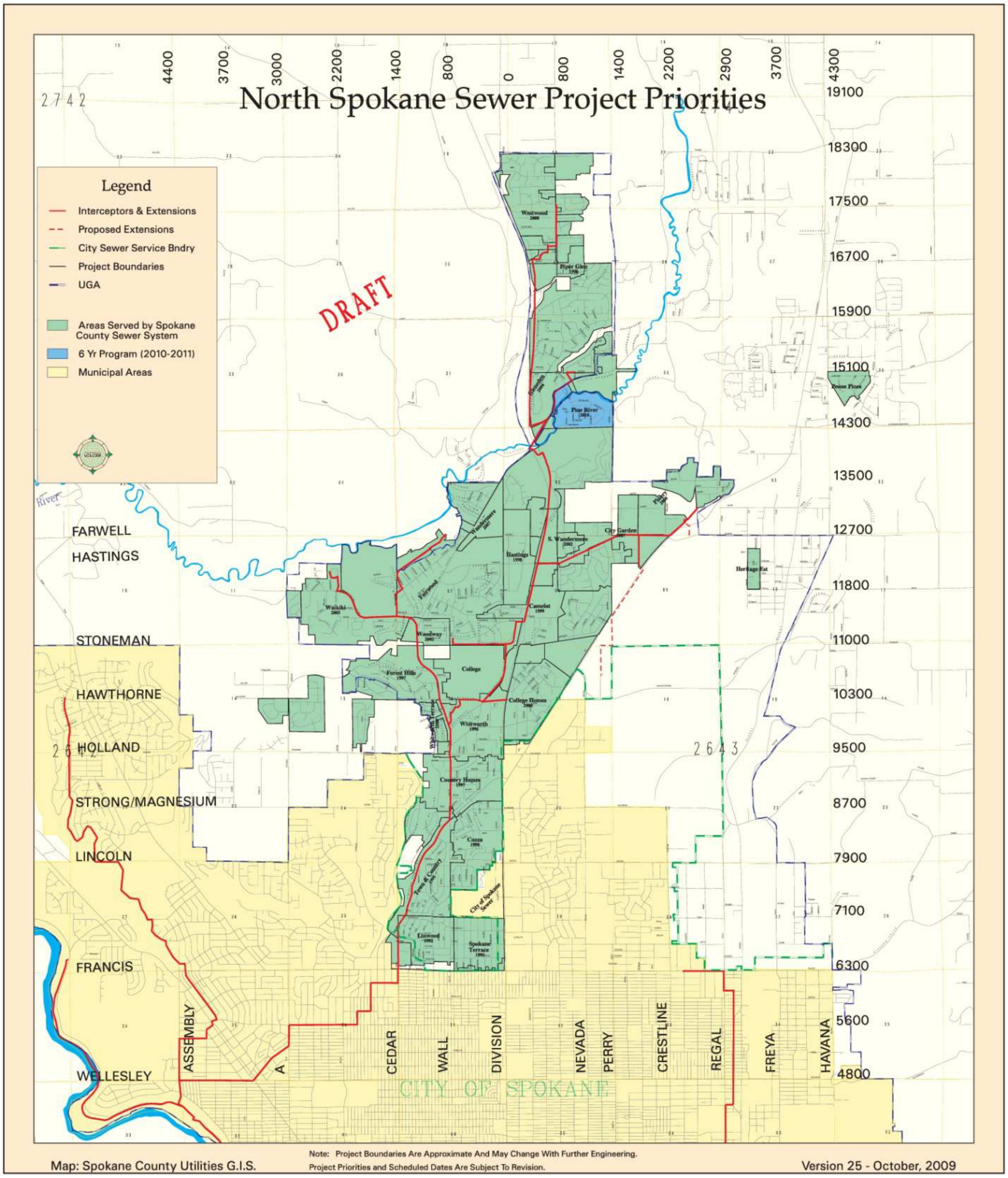
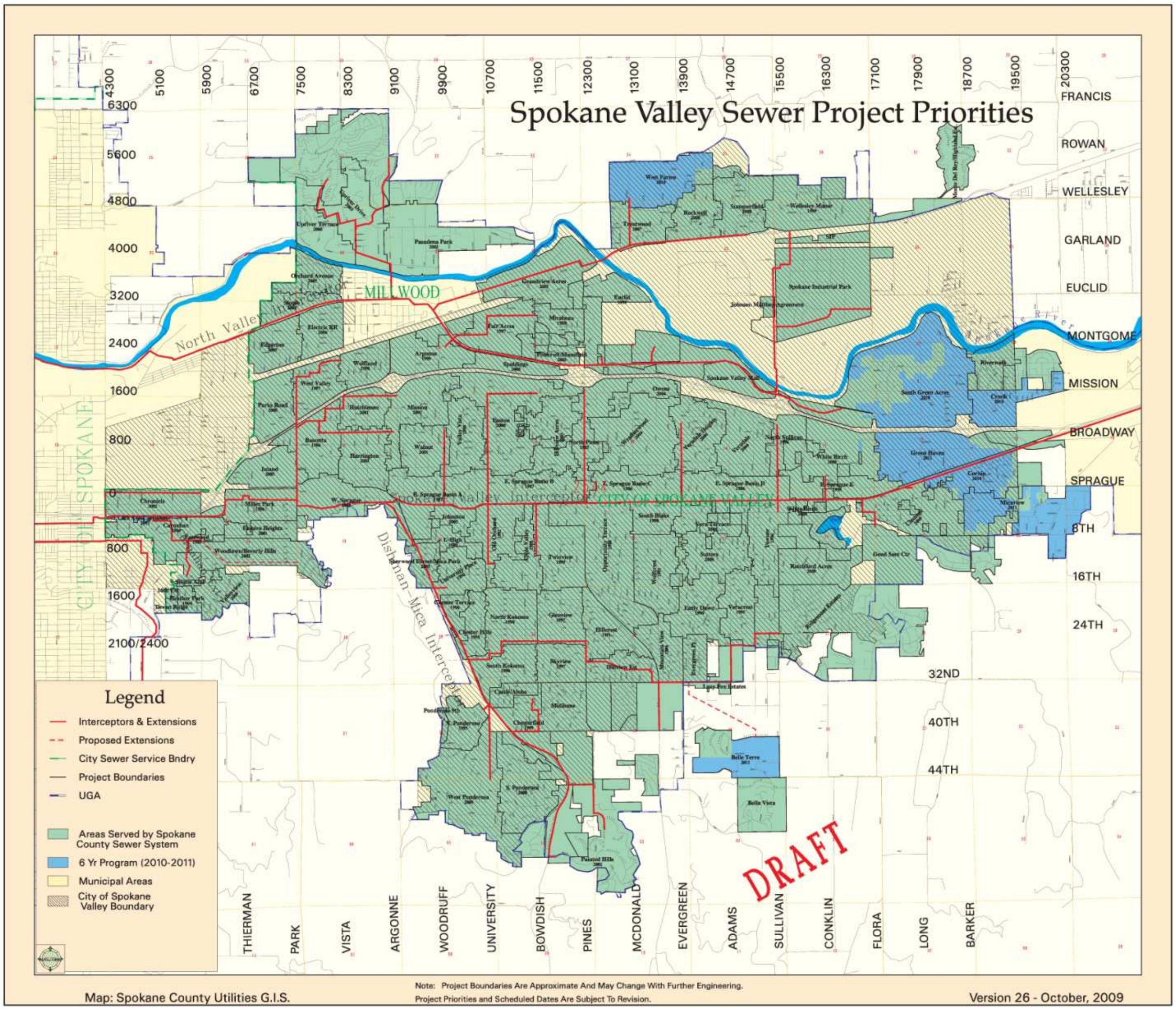


Figure 3: A Map of the Spokane Valley Service Area



Treatment Processes

The Spokane County Regional Water Reclamation Facility (SCRWRF) will provide advanced wastewater treatment to an initial 8 MGD of wastewater with an ability to expand capacity in phases up to 24 MGD. Spokane County will own and finance the Facility. CH2M Hill Constructors, Inc. will design and build the Facility, and will operate, maintain, and repair the Facility for an initial 20-year period. CH2M Hill Constructors, Inc. will also be responsible for on-site biosolids treatment. The County has selected a firm to haul the biosolids from the facility but contract details are not yet finalized. Several biosolids management alternatives have been considered including land application and composting.

The County has constructed improvements to the conveyance system, including the force mains, pump stations and the outfall for the Facility, as separate public works projects. The Facility includes a treatment process incorporating a step-feed nitrification/denitrification membrane bioreactor with chemical phosphorus removal and the following key components: fine screening, grit removal, primary clarification, sodium hypochlorite disinfection, liquid sodium bisulfite dechlorination, gravity belt thickening for primary and waste activated sludge, anaerobic digestion, aerobic digestion/solid storage, centrifuge dewatering, chemical feed systems and odor control systems. Sludge digestion employs both anaerobic and aerobic processes to further reduce effluent nitrogen content, reduce solids production and improve sludge quality. Other on-site facilities include an administration building with a laboratory, a water resource center, and a maintenance building.

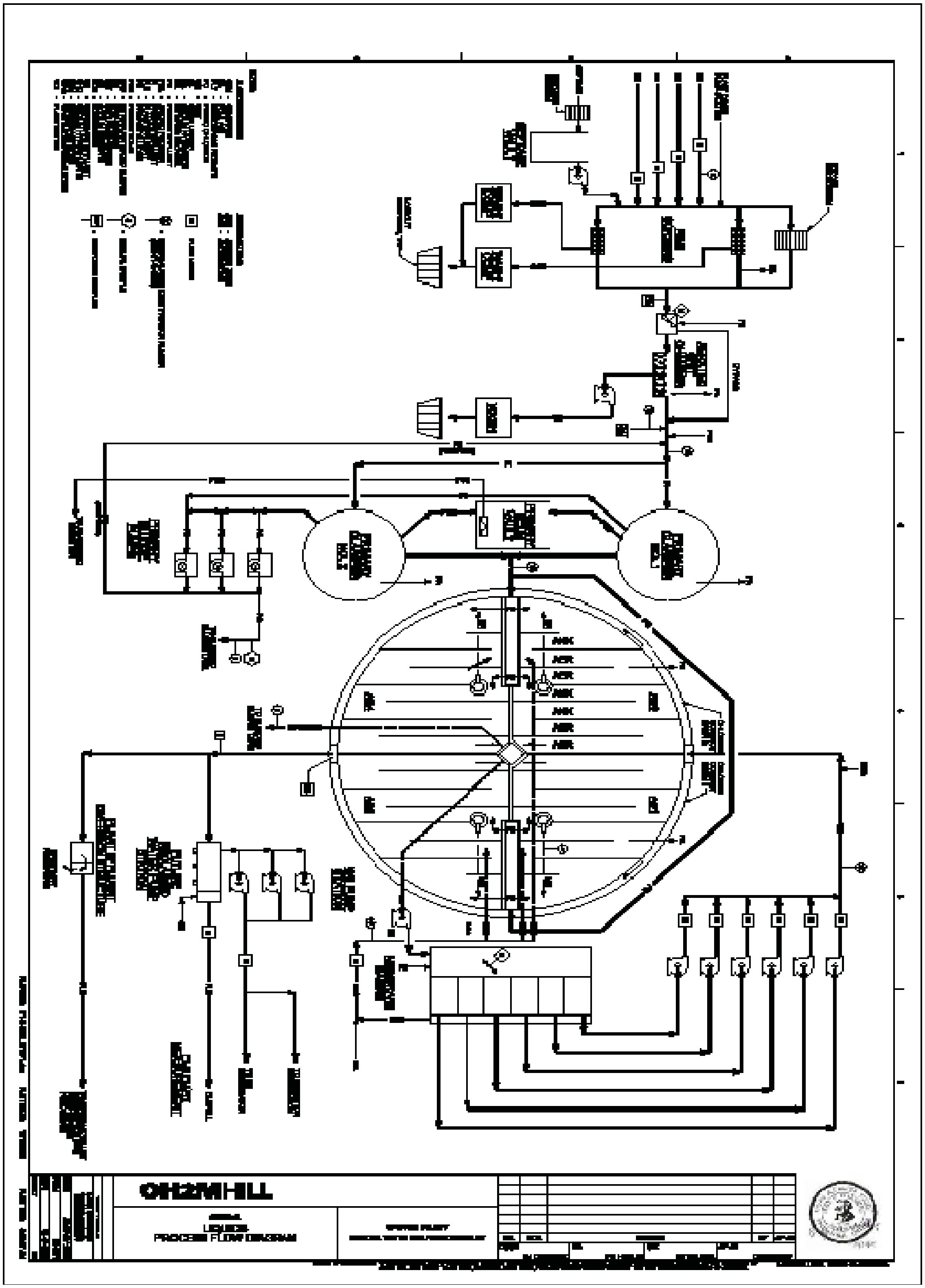
As an activated sludge treatment facility providing tertiary treatment (nitrification/denitrification with phosphorus removal) over 5 MGD the facility will be a Class IV facility.

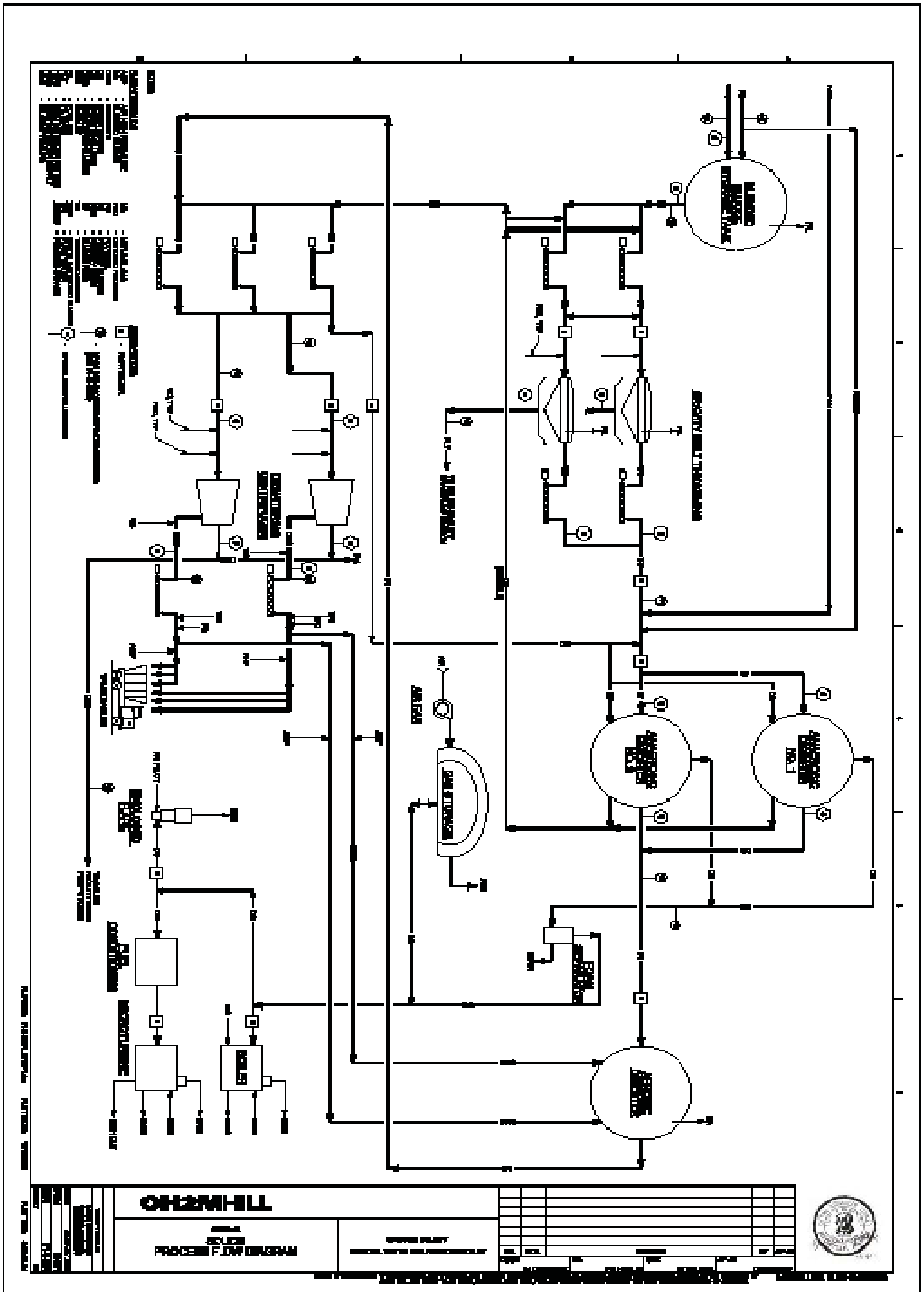
The portion of the County system in Spokane Valley has 2 Significant Industrial Users (SIUs) and 6 Categorical Industrial Users (CIUs).

Discharge Outfall

The treated, disinfected and dechlorinated effluent will flow into the Spokane River through a 36-inch diameter duckbill style Tideflex valve. The outfall extends north into the river about 75 feet beyond the ordinary high water level on the south bank of the river. The top of the pipe is roughly 15 feet below the ordinary high water. At the outfall location the river width varies from about 200 feet to 150 feet depending on river flow.

Figure 4: Schematics Diagrams of the Liquid and Solids Process Trains





Solid Wastes

The treatment facilities remove solids during the treatment of the raw wastewater at the headworks (grit and screenings), in addition to incidental solids (rags, scum, and other debris) removed as part of the routine maintenance of the equipment. Grit, rags, scum, and screenings are drained and disposed of as solid waste at the local landfill. Sludges removed from the primary clarifier and secondary treatments system are thickened and treated.

The solids process train is: gravity belt thickening for primary and waste activated sludge, anaerobic digestion, aerobic digestion/solid storage, and centrifuge dewatering. Spokane County evaluated several options for Biosolids management, including negotiation of an agreement with the City of Spokane to have the County biosolids land applied on the same land as the City. The selected option is composting at the Barr-Tech facility in Lincoln County. However, the details of a contract between the County and a joint contract CH2M-Hill and Barr-Tech are still being negotiated. A backup plan with Parker Ag is also being pursued.

B. Permit Status

This is a new, previously unpermitted facility. The existing wastewater is currently treated at the City of Spokane's Riverside Park Reclaimed Water Facility and discharged to the Spokane River.

The treatment facility is owned by the county and designed, built, operated and maintained by a contractor, CH2M-Hill Constructors, Inc. As such, Ecology must decide whether to issue the permit to each entity as co-permittees or to the County alone. The contract between Spokane County and CH2M-Hill Constructors, Inc. has been reviewed by Ecology and judged to provide adequate definition of responsibilities between the contracting parties. The responsibilities are found to be protective of water quality and in accord with Chapter 70.150 RCW. The permit will be issued to Spokane County, Utilities Division.

Spokane County Utilities Division submitted an application for a permit on September 30, 2010. Ecology accepted it as complete on October 15, 2010.

C. Wastewater Characterization

The expected concentration of pollutants in the discharge was reported in the NPDES permit application, the DBO performance guarantee, Appendix 10; and the June 2010 engineering report. The tabulated data represents the anticipated quality of the effluent to be discharged. The effluent is characterized as follows:

Table 2: Wastewater Characterization

Parameter	Average Concentration	Maximum Concentration
$CBOD_5$	--	2 mg/L
TSS*	<30 mg/L	--
Ammonia – N, March through May and October	1 mg/L	--
Ammonia – N, June through September	0.25 mg/L	--
Total Phosphorus, seasonal average	0.05 mg/L	--
* The treatment technology selected utilizes membranes producing a $CBOD_5$ of less than 2 mg/L and typically a TSS with a comparable single digit concentration.		

D. SEPA Compliance

To meet the intent of SEPA, an existing, unpermitted discharge must undergo SEPA review during the permitting process. The County filed a SEPA checklist and SERP environmental review documents (EIS) for federal funding with Ecology initially in February 2003 with updates in April 2004, and December 2006. Ecology issued a determination of non-significance for the project in February 2003. With the DO TMDL approved, the County submitted the final wastewater facilities amendment June 2010 and a final SERP concurrence was initiated. The Department of Archaeology and Historic Preservation (DAHP) issued their Determination of No Historic Properties affected on June 1, 2010.

The USEPA issued a determination of no effect on ESA listed species on November 11, 2010. Ecology reviewed the documentation and issued a SERP compliance determination on December 23, 2010.

III. PROPOSED PERMIT LIMITS

Federal and state regulations require that effluent limits in an NPDES permit must be either technology- or water quality-based.

- Technology-based limits are based upon the treatment methods available to treat specific pollutants. Technology-based limits are set by the EPA and published as a regulation, or Ecology develops the limit on a case-by-case basis (40 CFR 125.3, and chapter 173-220 WAC).

- Water quality-based limits are calculated so that the effluent will comply with the Surface Water Quality Standards (chapter 173-201A WAC), Ground Water Standards (chapter 173-200 WAC), Sediment Quality Standards (chapter 173-204 WAC) or the National Toxics Rule (40 CFR 131.36).

- Ecology must apply the most stringent of these limits to each parameter of concern. These limits are described below.

The limits in this permit reflect information received in the application and from supporting reports (engineering, hydrogeology, etc.). Ecology evaluated the permit application and determined the limits needed to comply with the rules adopted by the state of Washington. Ecology does not develop effluent limits for all reported pollutants**.** Some pollutants are not treatable at the concentrations reported, are not controllable at the source, are not listed in regulation, and do not have a reasonable potential to cause a water quality violation.

Nor does Ecology usually develop limits for pollutants that were not reported in the permit application but that may be present in the discharge. The permit does not authorize discharge of the non-reported pollutants. If significant changes occur in any constituent of the effluent discharge, or if other constituents are identified in effluent monitoring, Spokane County is required to notify Ecology (40 CFR 122.42(a)). Spokane County could potentially be in violation of the permit until Ecology modifies the permit to reflect the additional discharge of pollutants.

A. Design Criteria

Under WAC 173-220-150 (1)(g), flows and waste loadings must not exceed approved design criteria. Ecology-approved design criteria for this facility's treatment plant were obtained from the engineering report/facility plan/plans & specifications prepared by HDR, Inc. and CH2M Hill Constructors, Inc.

Table 3: Design Loading Criteria for the SCRWRF

Parameter	Design Quantity
Monthly Average Flow	8.0 MGD
Maximum Month Design Flow (MMDF)	8.5 MGD
Peak Design Flow (Peak Hour)	13.8 MGD
BOD_5 loading for maximum month	18,270 lbs/day
TSS loading for maximum month	20,080 lbs/day
Orthophosphate PO_4-P	281 lbs/day
Total Phosphorus TP	603.1 lbs/day
Ammonia NH_4-N	1,967 lbs/day
Total Nitrogen TN	2,978 lbs/day

B. Technology-Based Effluent Limits

Federal and state regulations define technology-based effluent limits for municipal wastewater treatment plants. These effluent limits are given in 40 CFR Part 133 (federal) and in chapter 173-221 WAC (state). These regulations are performance standards that constitute all known, available, and reasonable methods of prevention, control, and treatment (AKART) for municipal wastewater.

Chapter 173-221 WAC lists the following technology-based limits for pH, fecal coliform, BOD_5, and TSS:

Table 4: Technology-Based Limits

Parameter	Limit
pH	The pH must measure within the range of 6 to 9 standard units.
Fecal Coliform Bacteria	Monthly Geometric Mean = 200 organisms/100 mL Weekly Geometric Mean = 400 organisms/100 mL
BOD_5 (concentration)	Average Monthly Limit is the most stringent of the following: - 30 mg/L - may not exceed fifteen percent (15%) of the average influent concentration Average Weekly Limit = 45 mg/L
TSS (concentration)	Average Monthly Limit is the most stringent of the following: - 30 mg/L - may not exceed fifteen percent (15%) of the average influent concentration Average Weekly Limit = 45 mg/L

The above technology based limits are generally superseded by the requirement of the Spokane River and Lake Spokane DO TMDL directly (such as CBOD) or indirectly (such as TSS).

C. Surface Water Quality-Based Effluent Limits

Description of the Receiving Water

The Spokane County Regional Water Reclamation Facility will discharge to the Spokane River at river mile 78.7 (lat 47^o 40’ 33” long. 117^o 20’ 49”). Other nearby point sources are:

- Downstream outfalls for the City of Spokane are CSO outfalls 40, 39 and 38,
- CSO 41 which is directly across the river from the County’s outfall (a storage tank is to be installed in 2011),
- Inland Empire Paper outfall which is roughly 4 miles east or upstream.

In 1998, Ecology developed a Dissolved Metals TMDL for Zinc, Lead and Cadmium. The TMDL for Dissolved Oxygen was approved in May 2010. The Spokane River is also listed for PCBs and Ecology has published a reduction strategy *Reducing Toxics in the Spokane River Watershed*, August 2009 that includes PCBs.

The conventional ambient background data used for this permit includes the following from the Environmental Assessment Program’s monitoring station 57A140 at the Plante’s Ferry foot bridge at river mile 84.7. Finalized data exists for 2008 and 2009.

Table 5: Conventional Ambient Background Data

Parameter	Value Used
Temperature (highest annual 1-DADMax)	18.1^{o} C
Temperature (highest annual 7-DADMax)	NA
Temperature (**some waterbodies have specific temperature criteria as assigned in Table 602)	20^{o} C
pH (Maximum / Minimum)	8.06/7.58
Dissolved Oxygen	12.86 to 8.3 mg/L
Total Ammonia-N	No more than 0.019 mg/L
Fecal Coliform	21/100 mL dry weather (180/100 mL storm related)
Turbidity	1 NTU

The City of Spokane has done monitoring of fecal coliforms at Plantes Ferry during storm events. The highest storm related fecal coliform count was 240/100 ml on 9/17/2004.

The metal data is from monitoring station 57A150 at state line.

Table 6: Ambient Background Data for Metals

Parameter	Value used
Hardness	23.9 mg/L as CaCO3
Alkalinity*	21 mg/L as CaCO3
Lead	2 µg/L
Copper	1.0 µg/L
Zinc	53 µg/L
Cadmium	0.22 µg/L
*The alkalinity data was extracted from the EIM data base and is from Greg Pelletiers metal study, *Cadmium, Copper, Mercury, Lead and Zinc in the Spokane River*, (Publication 94-09) published in 1994.	

The following data is from the draft report "*Spokane River PCB Source Assessment 2003-2007*."

Table 7: Ambient Background Data for PCBs (Recheck)

Location description	**River Mile**	Mean Total **PCB** concentration in the water column, pg/L
Stateline	96.1	106
Upriver Dam	80.3	77
Monroe St.	74.8	199
Nine Mile	63.6	311

Nine Mile (2008)*	58.1	90
Lower Lake Spokane	38.4	399
**Trend Monitoring for Chlorinated Pesticides, PCBs, PAHs, and PBDEs in Washington Rivers and Lakes, 2008* sampling location at Nine Mile Dam RM 58.1 on 5/9/08 & 9/10/08.		

The Washington State Surface Water Quality Standards (chapter 173-201A WAC) are designed to protect existing water quality and preserve the beneficial uses of Washington's surface waters. Waste discharge permits must include conditions that ensure the discharge will meet the surface water quality standards (WAC 173-201A-510). Water quality-based effluent limits may be based on an individual waste load allocation or on a waste load allocation developed during a basin wide total maximum daily load study (TMDL).

Numerical Criteria for the Protection of Aquatic Life and Recreation

Numerical water quality criteria are listed in the water quality standards for surface waters (chapter 173-201A WAC). They specify the maximum levels of pollutants allowed in receiving water to protect aquatic life and recreation in and on the water. Ecology uses numerical criteria along with chemical and physical data for the wastewater and receiving water to derive the effluent limits in the discharge permit. When surface water quality-based limits are more stringent or potentially more stringent than technology-based limits, the discharge must meet the water quality-based limits.

Numerical Criteria for the Protection of Human Health

The U.S. EPA has published 91 numeric water quality criteria for the protection of human health that are applicable to dischargers in Washington State (EPA 1992). These criteria are designed to protect humans from exposure to pollutants linked to cancer and other disease, based on consuming fish and shellfish and drinking contaminated surface waters. The water quality standards also include radionuclide criteria to protect humans from the effects of radioactive substances.

Narrative Criteria

Narrative water quality criteria (e.g., WAC 173-201A-240(1); 2006) limit the toxic, radioactive, or other deleterious material concentrations that the facility may discharge to levels below those which have the potential to:

- Adversely affect designated water uses.
- Cause acute or chronic toxicity to biota.
- Impair aesthetic values.
- Adversely affect human health.

Narrative criteria protect the specific designated uses of all fresh waters (WAC 173-201A-200, 2006) and of all marine waters (WAC 173-201A-210, 2006) in the State of Washington.

Antidegradation

The purpose of Washington's Antidegradation Policy (WAC 173-201A-300-330; 2006) is to:

- Restore and maintain the highest possible quality of the surface waters of Washington.
- Describe situations under which water quality may be lowered from its current condition.
- Apply to human activities that are likely to have an impact on the water quality of surface water.
- Ensure that all human activities likely to contribute to a lowering of water quality, at a minimum, apply all known, available, and reasonable methods of prevention, control, and treatment (AKART).
- Apply three tiers of protection (described below) for surface waters of the state.

Tier I ensures existing and designated uses are maintained and protected and applies to all waters and all sources of pollutions. Tier II ensures that waters of a higher quality than the criteria assigned are not degraded unless such lowering of water quality is necessary and in the overriding public interest.

Tier II applies only to a specific list of polluting activities. Tier III prevents the degradation of waters formally listed as "outstanding resource waters," and applies to all sources of pollution.

A facility must prepare a Tier II analysis when all three of the following conditions are met:

- The facility is planning a new or expanded action. This condition applies to the new county treatment facility.
- Ecology regulates or authorizes the action. This condition applies to the new county treatment facility.
- The action has the potential to cause measurable degradation to existing water quality at the edge of a chronic mixing zone.

  However, the ambient water quality of the Spokane River is not better than the water quality standards human health criterion for PCBs. Long term trend monitoring does show decreasing PCB concentrations. The tertiary treatment processes under construction will further decrease concentrations of PCBS and other toxicants in the Spokane River. The tertiary treatment processes under construction is designed to comply with the requirements of the DO TMDL and will generally improve DO concentrations in the Spokane River.

  The issuance of an NPDES permit will not cause measurable degradation but will further ongoing improvements in water quality.

A tier II analysis is not required.

This facility must meet Tier I requirements.

- Dischargers must maintain and protect existing and designated uses. Ecology must not allow any degradation that will interfere with, or become injurious to, existing or designated uses, except as provided for in chapter 173-201A WAC.

Ecology's analysis described in this section of the fact sheet demonstrates that the existing and designated uses of the receiving water will be protected under the conditions of the proposed permit implementing the Spokane River and Lake Spokane DO TMDL, the Spokane River Dissolved Metals Total Maximum Daily Load. However, the Spokane Tribe's human health criterion for PCBs is problematic, given that the standard of 3.37 pg/L is below current method detection limits used in the report "*Spokane River PCB Source Assessment 2003-2007*." The reporting limit given was 100 pg/L (table 16 of the report).

The treatment technology selected to ensure compliance with the Spokane River and Lake Spokane DO TMDL will also ensure compliance with dissolved metals TMDL. For total PCB, the chronic fresh water criterion for aquatic organisms is 14,000 pg/L, the human health criterion from the National Toxics Rule (NTR) is 170 pg/L and the downstream tribal human health standard is 3.37 pg/L.

Currently the Spokane conventional secondary wastewater treatment facilities (Liberty Lake S&W District and Riverside Park Water Reclamation Facility) have estimated effluent concentrations that range from about 110 pg/L to about 2,400 pg/L, though the treatment processes themselves are not sources. While tertiary treatment will further reduce the effluent concentrations, how much is uncertain until further effluent data is available from the upgraded and operational advanced wastewater treatment which will be designed to comply with the requirements of the Spokane River and Lake Spokane DO TMDL. Also, while PCBs are considered a legacy pollutant and are prohibited in many products, the ban is not universal and many products currently in use continue to be sources of PCBs. For example, TOSCA allows PCBs in many currently used products such as paints, caulking and ink. By itself, no currently available treatment technology is likely to provide adequate removal sufficient to comply with either state water quality standard for PCBs or the more stringent tribal water quality standard. A broader, more comprehensive approach is needed. Aggressive toxic source identification, control and reduction or elimination is an essential part of the strategy. The County has floated the concept of a regional task force to attack the toxic issue and the concept has support from most stakeholders in the watershed. The rudiments of a Regional Toxics Task Force are described in the permit, but many details are left for the NPDES permittees and other stakeholders to cooperatively develop.

For a carcinogen the harmonic mean flow is used for calculating a dilution factor. The harmonic mean dilution factor is 35.7 for the new County facility (see table 12). The resulting PCB concentration in the water column could be less that the PCB concentration coming across the state line but still above the tribal standard. Where it specifically lies will depend on actual treatment efficiency and source control effectiveness and scope.

Mixing Zones

A mixing zone is the defined area in the receiving water surrounding the discharge port(s), where wastewater mixes with receiving water. Within mixing zones the pollutant concentrations may exceed water quality numeric standards, so long as the discharge does not interfere with designated uses of the receiving water body (for example, recreation, water supply, and aquatic life and wildlife habitat, etc.) The pollutant concentrations outside of the mixing zones must meet water quality numeric standards.

State and federal rules allow mixing zones because the concentrations and effects of most pollutants diminish rapidly after discharge, due to dilution. Ecology defines mixing zone sizes to limit the amount of time any exposure to the end-of-pipe discharge could harm water quality, plants, or fish.

The state's water quality standards allow Ecology to authorize mixing zones for the facility's permitted wastewater discharges only if those discharges already receive all known, available, and reasonable methods of prevention, control, and treatment (AKART) which will be case once the County's treatment facility is operational. Mixing zones typically require compliance with water quality criteria within a specified distance from the point of discharge and use no more than 25% of the available width of the water body for dilution. Ecology uses modeling to estimate the amount of mixing within the mixing zone. Through modeling Ecology determines the potential for violating the water quality standards at the edge of the mixing zone and through that process derives any necessary effluent limits. Steady-state models are the most frequently used tools for conducting mixing zone analyses. Ecology chooses values for each effluent and for receiving water variables that correspond to the time period when the most critical condition is likely to occur (see Ecology's *Permit Writer's Manual*). Each critical condition parameter, by itself, has a low probability of occurrence and the resulting dilution factor is conservative. The term "reasonable worst-case" applies to these values.

The mixing zone analysis produces a numerical value called a dilution factor (DF). A dilution factor represents the amount of mixing of effluent and receiving water that occurs at the boundary of the mixing zone. For example, a dilution factor of 10 means the effluent is 10% and the receiving water is 90% of the total volume of water at the boundary of the mixing zone. Ecology uses dilution factors with the water quality criteria to calculate reasonable potentials and effluent limits. Water quality standards include both aquatic life-based criteria and human health-based criteria, such as for PCBs. The former are applied at both the acute and chronic mixing zone boundaries; the latter are applied only at the chronic boundary. The concentration of pollutants at the boundaries of any of these mixing zones may not exceed the numerical criteria for that zone.

Each aquatic life **acute** criterion is based on the assumption that organisms are not exposed to that concentration for more than one hour and more often than one exposure in three years. Each aquatic life **chronic** criterion is based on the assumption that organisms are not exposed to that concentration for more than four consecutive days and more often than once in three years.

The two types of human health-based water quality criteria distinguish between those pollutants linked to non-cancer effects (non-carcinogenic) and those linked to cancer effects (carcinogenic) such as PCBs. The human health-based water quality criteria incorporate several exposure and risk assumptions. These assumptions include:

- A 70-year lifetime of daily exposures.
- An ingestion rate for fish or shellfish measured in kg/day.
- An ingestion rate of two liters/day for drinking water
- A one-in-one-million cancer risk for carcinogenic chemicals.

This permit authorizes a small acute mixing zone, surrounded by a chronic mixing zone around the point of discharge (WAC 173-201A-400). The water quality standards impose certain conditions before allowing the discharger a mixing zone:

1. **Ecology must specify both the allowed size and location in a permit.**

   The proposed permit specifies the size and location of the allowed mixing zone.

   For this discharge, the percent volume restrictions of the water quality standards resulted in a lower dilution factor than the distance and width restrictions. Therefore, the dilution factor calculated at a 10-year low flow was used to determine reasonable potential to exceed water quality standards. To design the outfall, the County's consultant followed Ecology's guidance and rules.

2. **The facility must fully apply "all known, available, and reasonable methods of prevention, control and treatment" (AKART) to its discharge.**

   Ecology has determined that the treatment provided at the Spokane County Regional Water Reclamation Facility employs treatment process going well beyond the requirements of AKART (see "Technology based Limits").

3. **Ecology must consider critical discharge conditions.**

   Surface water quality-based limits are derived for the waterbody's critical condition (the receiving water and waste discharge condition with the highest potential for adverse impact on the aquatic biota, human health, and existing or designated waterbody uses). The critical discharge condition is often pollutant-specific or waterbody-specific.

Critical discharge conditions are those conditions that result in reduced dilution or increased effect of the pollutant. Factors affecting dilution include the depth of water, the density stratification in the water column, the currents, and the rate of discharge. Density stratification is determined by the salinity and temperature of the receiving water. Temperatures are warmer in the surface waters in summer. Therefore, density stratification is generally greatest during the summer months. Density stratification affects how far up in the water column a freshwater plume may rise. The rate of mixing is greatest when an effluent is rising. The effluent stops rising when the mixed effluent is the same density as the surrounding water. After the effluent stops rising, the rate of mixing is much more gradual. Water depth can affect dilution when a plume might rise to the surface when there is little or no stratification. Ecology's *Permit Writer's Manual* describes additional guidance on criteria/design conditions for determining dilution factors. The manual can be obtained from Ecology's website at http://www.ecy.wa.gov/biblio/92109.html.

Ambient data at critical conditions in the vicinity of the outfall is found in the '*Spokane River and Lake Spokane Dissolved Oxygen TMDL*' report approved in May 2010.

The outfall was designed using the following critical conditions:

- Water depth at summer 7Q20 flow of about 16.2 feet. (figure 1 in TM)
- At summer 7Q20 flow the average ambient current speed is 0.38 fps or 0.116 m/sec. At a winter 7Q20 flow the average ambient current speed is 0.65 fps or 0.198 m/sec. (sec 4.2.4 in TM)
- 1 Day MAX Effluent temperature of 18.4 degrees C.

Table 8: **Design Flows for SCRWRF Outfall (MGD)**

Criterion	2012	2030	2060	Ultimate
Average Day	8.0	12.0	16.0	24.0
Maximum Month	8.5	12.6	16.8	25.2
Maximum Day	12.1	17.8	24	36.0
Peak Hour	18.4	26.4	36.4	52.8

4. Supporting information must clearly indicate the mixing zone would not:

- **Have a reasonable potential to cause the loss of sensitive or important habitat.**
- **Substantially interfere with the existing or characteristic uses.**
- **Result in damage to the ecosystem.**
- **Adversely affect public health.**

Ecology established Washington State water quality criteria for toxic chemicals using EPA criteria. EPA developed the criteria using toxicity tests with numerous organisms and set the criteria to generally protect the species tested and to fully protect all commercially and recreationally important species.

EPA sets acute criteria for toxic chemicals assuming organisms are exposed to the pollutant at the criteria concentration for one hour. They set chronic standards assuming organisms are exposed to the pollutant at the criteria concentration for four days. Dilution modeling under critical conditions generally shows that both acute and chronic criteria concentrations are reached within minutes of being discharged.

The discharge plume does not impact drifting and non-strong swimming organisms because they cannot stay in the plume close to the outfall long enough to be affected. Strong swimming fish could maintain a position within the plume, but they can also avoid the discharge by swimming away. The SCRWRF discharge plume is small and the presence of a strong swimming fish for long is minimal. Mixing zones generally do not affect benthic organisms (bottom dwellers) because the buoyant plume rises in the water column. Ecology has additionally determined that the temperature of the water will not create lethal conditions or blockages to fish migration.

Ecology evaluates the cumulative toxicity of an effluent by testing the discharge with whole effluent toxicity (WET) testing.

Ecology reviewed the above information, the specific information on the characteristics of the discharge, the receiving water characteristics and the discharge location. Based on this review, Ecology concluded that the discharge does not have a reasonable potential to cause the loss of sensitive or important habitat, substantially interfere with existing or characteristics uses, result in damage to the ecosystem, or adversely affect public health if the permit limits are met.

5. The discharge/receiving water mixture must not exceed water quality criteria outside the boundary of a mixing zone.

Ecology conducted a reasonable potential analysis using procedures established by the EPA and by Ecology for each pollutant and concluded the discharge/receiving water mixture will not violate water quality criteria outside the boundary of the mixing zone if permit limits are met.

6. The size of the mixing zone and the concentrations of the pollutants must be minimized.

At any given time, the effluent plume uses only a portion of the acute and chronic mixing zone, which minimizes the volume of water involved in mixing. The plume rises through the water column as it mixes, therefore much of the receiving water volume at lower depths in the mixing zone may not mix with discharge. The County installed a duckbill style diffuser for mixing.

When a diffuser is installed, the discharge is more completely mixed with the receiving water in a shorter time. Ecology also minimizes the size of the mixing zone (in the form of the dilution factor) using design criteria with a low probability of occurrence. For example, Ecology uses the expected 95th percentile pollutant concentration, the 90th percentile background concentration, the centerline dilution factor, and the lowest flow occurring once in every ten years to perform the reasonable potential analysis.

Because of the above reasons, Ecology has effectively minimized the size of the mixing zone authorized in the proposed permit.

7. Maximum size of mixing zone.

The authorized mixing zone does not exceed the maximum size restriction.

8. Acute Mixing Zone.

- **The discharge/receiving water mixture must comply with acute criteria as near to the point of discharge as practicably attainable.**

  Ecology requires that the acute criteria will be met at 10% of the volume of the chronic mixing zone at the ten year low flow. The design accommodates this requirement.

- **The pollutant concentration, duration, and frequency of exposure to the discharge will not create a barrier to migration or translocation of indigenous organisms to a degree that has the potential to cause damage to the ecosystem.**

  As described above, the toxicity of any pollutant depends upon the exposure, the pollutant concentration, and the time the organism is exposed to that concentration. Authorizing a limited acute mixing zone for this discharge assures that it will not create a barrier to migration. The effluent from this discharge will rise as it enters the receiving water, assuring that the rising effluent will not cause translocation of indigenous organisms near the point of discharge (below the rising effluent). The plume is also small and will not cause translocation of indigenous organisms near the point of discharge.

- **Comply with size restrictions.**

  The mixing zone authorized for this discharge complies with the size restrictions published in chapter 173-201A WAC.

9. Overlap of Mixing Zones.

This mixing zone does not overlap another mixing zone. No other outfall is in close enough proximity. The only nearby outfall is the other side of the river and flow is very intermittent.

D. Designated Uses and Surface Water Quality Criteria

Applicable designated uses and surface water quality criteria are defined in chapter 173-201A WAC. In addition, the U.S. EPA set human health criteria for toxic pollutants (EPA 1992). Criteria applicable to this facility's discharge are summarized below in Table 9.

- Aquatic Life Uses are designated based on the presence of, or the intent to provide protection for, the key uses. All indigenous fish and non-fish aquatic species must be protected in waters of the state in addition to the key species. The Aquatic Life Uses for this receiving water are identified below.

Table 9: Aquatic Life Uses & Associated Criteria

Salmonid Spawning, Rearing, and Migration	
Temperature Criteria – Highest 7DAD MAX	17.5°C (63.5°F)
Temperature Criteria – 1-DayMax	20.0°C due to human activities.
Dissolved Oxygen Criteria – Lowest 1-Day Minimum	8.0 mg/L
Turbidity Criteria	• 5 NTU over background when the background is 50 NTU or less; or • A 10 percent increase in turbidity when the background turbidity is more than 50 NTU
Total Dissolved Gas Criteria	Total dissolved gas shall not exceed 110 percent of saturation at any point of sample collection
pH Criteria	pH shall be within the range of 6.5 to 8.5 with a human-caused variation within the above range of less than 0.5 units

- The recreational uses are primary contact recreation. The recreational uses for this receiving water are identified below.

Table 10: Recreational Uses and Associated Criteria

Recreational Use	Criteria
Primary Contact Recreation	Fecal coliform organism levels must not exceed a geometric mean value of 100 colonies /100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 200 colonies /100 mL.

- The **water supply uses** are domestic, agricultural, industrial, and stock watering.
- The **miscellaneous freshwater use**s are wildlife habitat, harvesting, commerce and navigation, boating, and aesthetics.

E. Evaluation of Surface Water Quality-Based Effluent Limits for Numeric Criteria

Pollutants in an effluent may affect the aquatic environment near the point of discharge (near-field) or at a considerable distance from the point of discharge (far-field).

Toxic pollutants, for example, are near-field pollutants—their adverse effects diminish rapidly with mixing in the receiving water. Conversely, a pollutant such as biological oxygen demand (BOD) is a far-field pollutant whose adverse effect occurs away from the discharge even after dilution has occurred.

Thus, the method of calculating surface water quality-based effluent limits varies with the point at which the pollutant has its maximum effect.

With technology-based controls (AKART), predicted pollutant concentrations in the discharge exceed water quality criteria. Ecology therefore authorizes a mixing zone in accordance with the geometric configuration, flow restriction, and other restrictions imposed on mixing zones by chapter 173-201A WAC.

The treated and disinfected effluent flows into the Spokane River through a 36-inch diameter duckbill style Tideflex valve. The outfall extends north into the river about 75 feet beyond the ordinary high water level on the south bank of the river. Top of pipe is roughly 15 feet below the ordinary high water.

Chronic Mixing Zone

WAC 173-201A-400(7)(a) specifies that mixing zones must not extend in a downstream direction from the discharge ports for a distance greater than 300 feet plus the depth of water over the discharge ports or extend upstream for a distance of over 100 feet, not utilize greater than **25%** of the flow, and not occupy greater than **25%** of the width of the water body.

Acute Mixing Zone

WAC 173-201A-400(8)(a) specifies that in rivers and streams a zone where acute toxics criteria may be exceeded must not extend beyond 10% of the distance towards the upstream and downstream boundaries of the chronic zone, not use greater than **2.5%** of the flow and not occupy greater than **25%** of the width of the water body.

The dilution factors, shown in the table below, are predicted for the SCRWRF outfall in the Technical Memorandum *Task G102 – Mixing Zone and Water Quality Update* from Cosmopolitan Engineers to HDR Engineers representing Spokane County Utilities, dated October 29, 2007

Table 11: **Predicted Mixing Zone Dimensions and Dilution Factors by Cosmopolitan Engineers**

Season	Distance to mixing zone boundary		Dilution at mixing zone boundary		Plume Width at chronic mixing zone boundary (ft.)
	Acute (ft.)	Chronic (ft.)	Acute (ft.)	Chronic (ft.)	
Summer	**4.7**	**47**	**1.4**	**8.6**	**21**
Winter	**12**	**118**	**2.6**	**15**	**18**

Table 12: Ecology determined Dilution Factors (DF)

	Summer		Winter	
Criteria	**Acute**	**Chronic**	**Acute**	**Chronic**
Aquatic Life	1.77	11.89	2.41	20.90
Human Health, Carcinogen		35.72		64.44
Human Health, Non-carcinogen		16.78		28.86

Ecology determined the dilution factors in Table 12 using a summer 7Q20 of 573 cfs and a winter 7Q20 of 1047 cfs (Pelletier 1997).

Ecology will use the dilution zone determined by the County consultants for defining a maximum size for the dilution zone in the proposed permit. It reflects a future design flow of 12 MGD. Table 12 reflects dilution factors for a design flow of 8 MGD. Ecology determined the impacts of dissolved oxygen deficiency as part of the modeling for the Spokane River and Lake Spokane DO TMDL which was approved by the USEPA in May 2010.

Ecology determined the impacts of Temperature, pH, Fecal Coliform, Chlorine, Ammonia Toxicity, and Metals, as described below, using the dilution factors in the above Table 12. The derivation of surface water quality-based limits also takes into account the variability of pollutant concentrations in both the effluent and the receiving water.

Oxygen Demanding Pollutants

The Spokane River and Lake Spokane (Long Lake) Dissolved Oxygen TMDL report sets WLAs for Total Phosphorus, $CBOD_5$, and Ammonia for each NPDES discharger to the Spokane River. The TMDL's managed implementation plan outlines the approach Ecology will take to meet these waste load allocations (WLAs) and ultimately achieve the water quality standard for dissolved oxygen in Lake Spokane.

This approach is spread over a twenty year managed implementation plan (MIP). During the first ten years of the MIP, efforts focus on phosphorus reduction to the Spokane River.

Before the end of the first ten years of the MIP, a thorough assessment will provide any necessary information to guide actions for the second ten year period.

These second period actions will include continuation of successful measures conducted in the first 10 years, such as operation of the phosphorus treatment technology and other permanent phosphorous reduction efforts. They may also include new actions such as additional treatment technologies, consideration of river oxygenation, and/or reconsideration of Water Quality Standards applied to the River and Lake Spokane. If new information from the "Ten Year Assessment" justifies relaxing WLAs and the water quality-based effluent limits (WQBELs), Ecology will relax the WQBELs. If so, the following section in federal regulation regarding "anti-backsliding" applies:

122.44(l) Reissued permits.
1) ***Except as provided in paragraph (l)(2)*** *of this section when a permit is renewed or reissued, interim effluent limitations, standards or conditions must be at least as stringent as the final effluent limitations, standards, or conditions in the previous permit (unless the circumstances on which the previous permit was based have materially and substantially changed since the time the permit was issued and would constitute cause for permit modification or revocation and reissuance under Sec. 122.62.)*

(2) In the case of effluent limitations established on the basis of Section 402(a)(1)(B) of the CWA, a permit may not be renewed, reissued, or modified on the basis of effluent guidelines promulgated under section 304(b) subsequent to the original issuance of such permit, to contain effluent limitations which are less stringent than the comparable effluent limitations in the previous permit.
(i) ***Exceptions****--A permit with respect to which paragraph (l)(2) of this section applies may be renewed, reissued, or modified to contain a less stringent effluent limitation applicable to a pollutant, if--*
Information is available which was not available at the time of permit issuance (other than revised regulations, guidance, or test methods) and which would have justified the application of a less stringent effluent limitation at the time of permit issuance; or

Ecology will establish WLAs and WQBELs on the best scientific information and interpretation available based on the facts that the "Ten Year Assessment" produces. Ecology will also examine and revise as needed the implementation of water quality based effluent limitations in terms of long term average versus monthly averages or maximums.

$CBOD_5$ - For the Spokane County Regional Water Reclamation Facility, SCRWRF, the Spokane River and Lake Spokane DO TMDL projects that compliance requires the effluent $CBOD_5$ concentration be less than 4.2 mg/L.

The effluent limitation will express this as a mass limit for the season March 1 to October 31 (245 days) of 280.2 lbs/day or 68,654 lbs total for the season.

Phosphorus - For the Spokane County Regional Water Reclamation Facility, SCRWRF, the Spokane River and Lake Spokane DO TMDL projects that compliance requires the effluent Total Phosphorus concentration be less 42 ug/L on a monthly average basis.

The effluent limitation will express the monthly average of 42 ug/L as a mass limit for the season March 1 to October 31 (245 days) of 2.80 lbs/day or 686.5 lbs total for the season.

Ammonia - For the Spokane County Regional Water Reclamation Facility, SCRWRF, the Spokane River and Lake Spokane DO TMDL projects that compliance requires the effluent ammonia to have less than the following loadings:

The following 3 seasons will have average mass per day limit as noted below:

1. For the season of March 1 to May 30, the allowable mass of NH_3 is 55.4 lbs/day.
2. For the season of June 1 to September 30, the allowable mass of NH_3 is 14.0 lbs/day.
3. For the season of October 1 to October 31, the allowable mass of NH_3 is 55.4 lbs/day.

For the 3 parameters above, federal rules normally require publically owned treatment works to have effluent limitations to be expressed in terms of monthly and weekly averages and daily maximums for applicable toxicants. However, that is not a mandatory permit requirement and 40 CFR122.45(d) does allow that if the normal monthly averages, weekly averages and daily maximum are impractical, alternatives such as an annual or seasonal limit may be appropriate. For the Spokane River and Spokane Lake system impractical means the water body does not respond in a measurable way to short term variations. Therefore, long term trend analysis and measurements descriptive of long term trends such as seasonal averages and seasonal totals are appropriate.

For the municipal dischargers to the Spokane River and Spokane Lake system impractical also means that reliable data sets with log normal distributions for conversion of maximums to averages do not exist. In Chesapeake Bay, EPA recognized that temperature affected plant performance resulting in a skewed data set, making it impracticable to establish monthly and weekly averages. For Chesapeake Bay the U.S. EPA cited reasons of temperature affecting plant performance resulting in a skewed data set. A skewed data set can also result when the low end of the data set is determined by the detection limit. Both reasons apply in this situation, leading to the conclusion that it is currently impracticable to establish monthly and weekly effluent limitations for all 3 parameters.

Pollutant Equivalencies and Alternate Effluent Limitations

The County's approved Wastewater Facilities Plan (WWFP) amendment Chapter 2 (Final – June 2010) addressed pollutant equivalency through modeling using the CE-Qual-W2 model that established the Spokane River and Lake Spokane DO TMDL and WLAs.
With the technology selected, the $CBOD_5$ should be less than 2.0 mg/L. In fact the County's contract with the DBO contractor, CH2M Hill constructors requires the $CBOD_5$ be 2.0 mg/L or less.

The WWFP amendment considered 2 scenarios this capability provides. Both scenarios considered a TP of 50 ug/L or less. The scenarios were:

1) An ammonia excursion due to cold water temperatures and poor nitrification of up to 16 mg/L in March, the remainder of spring (April through May) at 1.0 mg/L, Summer (June through September) at 0.25 mg/L, and October at 1.0 mg/L

2) 1.0 mg/L for March through May, Summer (June through September) at 0.25 mg/L, and October at 1.0 mg/L

In both scenarios DO concentrations improve very slightly according to the CE-Qual-W2 model predictions, see table 2 of the Limno Tech memo of March 11, 2010 that is in the Wastewater Facilities Plan Amendment of June 2010. The model does justify the use of alternate effluent limitation due to the ability of the treatment processes to remove $CBOD_5$ to below 2.0 mg/L

In May of 2011, Limno Tech and Ecology both ran the CE-Qual-W2 model with alternate limits for Spokane County and the Idaho dischargers. In this run a 16 mg/L daily maximum for ammonia was considered for the County discharge with TP of 50 ug/L and CBOD5 of 2.0 mg/L. This model run also confirmed the viability of alternate permit limits for a group of dischargers.

Temperature - The state temperature standards (WAC 173-201A-200-210 and 600-612) include multiple elements:

- Annual summer maximum threshold criteria (June 15 to September 15).
- Supplemental spawning and rearing season criteria (September 15 to June 15) but such are not defined for the Spokane River/
- Incremental warming restrictions.
- Protections against acute effects.

Ecology evaluates each criterion independently to determine reasonable potential and derive permit limits.

- Annual summer maximum and supplementary spawning/rearing criteria.

  Each water body has an annual maximum temperature criterion [WAC 173-201A-200(1)(c), 210(1)(c), and Table 602]. These threshold criteria (e.g., 12, 16, 17.5, 20°C) protect specific categories of aquatic life by controlling the effect of human actions on summer temperatures.

Some waters, not the Spokane River, have an additional threshold criterion to protect the spawning and incubation of salmonids (9°C for char and 13°C for salmon and trout) [WAC 173-201A-602, Table 602]. These criteria apply during specific date-windows.

The threshold criteria apply at the edge of the chronic mixing zone. Criteria for most fresh waters are expressed as the highest 7-Day average of daily maximum temperature (7-DADMax).

The 7-DADMax temperature is the arithmetic average of seven consecutive measures of daily maximum temperatures. Criteria for marine waters and some fresh waters are expressed as the highest 1-Day annual maximum temperature (1-DMax).

- Incremental warming criteria

The water quality standards limit the amount of warming human sources can cause under specific situations [WAC 173-201A-200(1)(c)(i)-(ii), 210(1)(c)(i)-(ii)]. The incremental warming criteria apply at the edge of the chronic mixing zone.

At locations and times when background temperatures are cooler than the assigned threshold criterion, point sources are permitted to warm the water by only a defined increment.

These increments are permitted only to the extent doing so does not cause temperatures to exceed either the annual maximum or supplemental spawning criteria.

At locations and times when a threshold criterion is being exceeded due to natural conditions, all human sources, considered cumulatively, must not warm the water more than 0.3°C above the naturally warm condition.

When Ecology has not yet completed a temperature TMDL, our policy allows each point source to warm water at the edge of the chronic mixing zone by 0.3°C. This is true regardless of the background temperature and even if doing so would cause the temperature at the edge of a standard mixing zone to exceed the numeric threshold criteria. Allowing a 0.3°C warming for each point source is reasonable and protective where the dilution factor is based on 25% or less of the critical flow. This is because the fully mixed effect on temperature will only be a fraction of the 0.3°C cumulative allowance (0.075°C or less) for all human sources combined.

- Temperature Acute Effects

Instantaneous lethality to passing fish: The upper 99th percentile daily maximum effluent temperature must not exceed 33°C; unless a dilution analysis indicates ambient temperatures will not exceed 33°C 2-seconds after discharge.

General lethality and migration blockage: Measurable (0.3°C) increases in temperature at the edge of a chronic mixing zone are not allowed when the receiving water temperature exceeds either a 1DMax of 23°C or a 7DADMax of 22°C.

Lethality to incubating fish: Human actions must not cause a measurable (0.3°C) warming above 17.5°C at locations where eggs are incubating.

Annual summer maximum, and incremental warming criteria: Ecology calculated the reasonable potential for an assumed discharge temperature based on the City of Spokane operational data to exceed the annual summer maximum, and the incremental warming criteria at the edge of the chronic mixing zone during critical condition(s). No reasonable potential exists to exceed the temperature criterion where:

(Criterion + 0.3) > (Criterion + ($T_{effluent95}$ – Criterion))/DF

(20 + 0.3) > (20 + (20.5 – 20))/11.89). 20.3 > 1.72

Therefore, the proposed permit does not include a temperature limit. The permit requires additional monitoring of effluent and ambient temperatures. Ecology will reevaluate the reasonable potential during the next permit renewal.

pH - Ecology modeled the impact of the effluent pH on the receiving water using the calculations from EPA, 1988, and the chronic dilution factor of 11.89. The receiving water input variables used are listed above in Table 5. The effluent input variables used are assumed.

Under critical conditions, modeling predicts a violation of the pH criteria for the receiving water if the effluent pH drops below 7.0 with an ambient alkalinity of 40 mg/L $CaCO_3$ or less. Therefore, the proposed permit includes water quality-based effluent limits for pH of 7.0 to 9.0. The permit will require monitoring of alkalinity of the effluent and the receiving water.

Fecal Coliform – The approved design criteria is 200 colonies per 100ml (200 cfu/100mL) monthly average. Ecology modeled the numbers of fecal coliform by simple mixing analysis using the technology-based limit of 200 organisms per 100 mL and an acute dilution zone factor of 1.77. At the design value and with a 7Q10 flow the water quality standard would be exceeded slightly immediately beyond the acute mixing zone, 4.7 feet from the end of the tideflex valve. With the depth of the diffuser, small size of dilution zone, velocity of water, cobbly nature of the river bank and vegetation, there is no significant public health risk that the EPA guidance seeks to avoid. Additionally, the SCRWRF will perform much better than the approved design criteria. It is anticipated that the fecal coliform count will be below 100 cfu/100ml exiting the membranes and disinfection will reduce it further. Meeting the water quality criterion of 100 cfu/100 mL at end of pipe is attainable and very likely realized.

Toxic Pollutants - Federal regulations (40 CFR 122.44) require Ecology to place limits in NPDES permits on toxic chemicals in an effluent whenever there is a reasonable potential for those chemicals to exceed the surface water quality criteria.
Ecology does not exempt facilities with technology-based effluent limits from meeting the surface water quality standards.

The following toxic pollutants are present in the discharge: Ammonia, Chlorine, Heavy Metals, PCBs, Dioxins and PBDEs. Ecology conducted a reasonable potential analysis (See **Appendix D**) on these parameters to determine whether it would require effluent limits in this permit.

Ammonia's toxicity depends on that portion which is available in the unionized form. The amount of unionized ammonia depends on the temperature and pH in the receiving freshwater. To evaluate ammonia toxicity, Ecology used the available receiving water information for ambient stations and Ecology spreadsheet tools.

Valid ambient background data was available for ammonia, heavy metals and PCBs. Though for PCBs the quantity of data was limited. Ecology used all applicable data to evaluate reasonable potential for this discharge to cause a violation of water quality standards. The ambient stations were 54A120 and 57A150 for metals and hardness; 54A130, 57A125, 57A140 and 57A150 for conventional parameters.

Ecology determined that ammonia has no reasonable potential to exceed the toxicity water quality criteria. However, the County contract with CH2M Hill Constructors has maximum day limits based on higher flows than the first phase facility accommodates which are reflected in the permit. The no reasonable potential scenario was modeled using procedures given in EPA, 1991 (**Appendix D)**.

The Heavy Metals TMDL requires either a performance based limit or a water quality based limit using the end of pipe hardness which is unknown. Ambient concentrations for Cadmium, Lead and Zinc exceed the water quality standards. The calculations for reasonable potential require a maximum effluent concentration which isn't available. Instead, the County's permit application proposed to use the effluents limits for the Riverside Park Water Reclamation Facility under the assumption that the influent pollutant concentrations would be similar. The SCRWRF will also be employing the next level of treatment, chemical addition and filtration, and would be expected to provide better metals removal than the current Riverside Park Water Reclamation Facility. Additionally, the SCRWRF has a larger dilution factor so that using RPWRF effluent limits for metals is deemed to be conservative and acceptable until operational data is available.

The resultant effluent limits are as follows:

Parameter	Average Monthly	Maximum Daily
Cadmium (total)	0.076 μg/L	0.233 μg/L
Lead (total)	0.772 μg/L	1.34 μg/L
Zinc (total)	53.8 μg/L	72.6 μg/L
Total Ammonia (as NH_3-N)		
For "season" of March 1 to May 31	55.4 lbs/day	16 mg/L
For "season" of June 1 to Sept. 30	14.0 lbs/day	7.5 mg/L
For "season" of Oct. 1 to Oct. 31	55.4 lbs/day	16 mg/L

Water quality criteria for most metals published in chapter 173-201A WAC are based on the dissolved fraction of the metal (see footnotes to table WAC 173-201A-240(3); 2006).

Spokane County Utilities may provide data clearly demonstrating the seasonal partitioning of the dissolved metal in the ambient water in relation to an effluent discharge. Ecology may adjust metals criteria on a site-specific basis when data is available clearly demonstrating the seasonal partitioning in the ambient water in relation to an effluent discharge.

F. Whole Effluent Toxicity

The water quality standards for surface waters forbid discharge of effluent that causes toxic effects in the receiving waters. Many toxic pollutants cannot be measured by commonly available detection methods. However, laboratory tests can measure toxicity directly by exposing living organisms to the wastewater and measuring their responses. These tests measure the aggregate toxicity of the whole effluent, so this approach is called whole effluent toxicity (WET) testing. Some WET tests measure acute toxicity and other WET tests measure chronic toxicity.

- *Acute toxicity tests measure mortality as the significant response* to the toxicity of the effluent. Dischargers who monitor their wastewater using acute toxicity tests find early indications of any potential lethal effect of the effluent on organisms in the receiving water.
- *Chronic toxicity tests measure various sublethal toxic responses*, such as retarded growth or reduced reproduction. Chronic toxicity tests often involve either a complete life cycle test on an organism with an extremely short life cycle, or a partial life cycle test during a critical stage of a test organism's life. Some chronic toxicity tests also measure organism survival.

Using the screening criteria in WAC 173-205-040, Ecology determined that the Spokane County Regional Water Reclamation Facility's effluent has the potential to cause aquatic toxicity based solely on probable influent characteristics. Spokane County has a delegated pretreatment program indicative of influent organic and inorganic compounds not necessarily removed by wastewater treatment adequately. To verify protection of beneficial uses, the proposed permit contains WET testing requirements as authorized by RCW 90.48.520 and 40 CFR 122.44, using procedures from WAC 173-205.

The proposed permit requires the facility to conduct WET testing at prescribed intervals for one year, to characterize both the acute and chronic toxicity of the effluent.

If the year of WET testing shows acute or chronic toxicity levels that have a reasonable potential to cause receiving water toxicity, then the proposed permit will:

- Set a limit on acute or chronic toxicity.
- Require this facility operator to conduct WET testing to monitor compliance with an acute toxicity limit, a chronic toxicity limit, or both.
- Specify the procedures the facility operator must use to come back into compliance if toxicity exceeds the limits.

Ecology-accredited WET testing laboratories use the proper WET testing protocols, fulfill the data requirements, and submit results in the correct reporting format.

Accredited laboratory staff knows how to calculate an NOEC, LC_{50}, EC_{50}, IC_{25}, etc. Ecology gives all accredited labs the most recent version of Ecology Publication No. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria* (http://www.ecy.wa.gov/biblio/9580.html), which is referenced in the permit. Ecology recommends that each regulated facility send a copy of the acute or chronic toxicity sections(s) of its NPDES permit to the laboratory.

If the WET tests performed for effluent characterization purposes indicate no reasonable potential to cause receiving water toxicity, the proposed permit will not impose WET limits, but will require rapid screening tests to detect any toxicity that may appear.

- If a rapid screening test indicates apparent effluent toxicity, the facility operator must investigate immediately, take appropriate action, and report to Ecology.
- If this facility makes process or material changes which, in Ecology's opinion, increase the potential for effluent toxicity, then Ecology may (in a regulatory order, by permit modification, or in the permit renewal) require the facility to conduct additional effluent characterization.
- If WET testing conducted as a follow-up to rapid screening tests fails to meet the performance standards in WAC 173-205-020, Ecology will assume that effluent toxicity has increased.

G. Human Health

Washington’s water quality standards include 91 numeric human health-based criteria that Ecology must consider when writing NPDES permits. These criteria were established in 1992 by the U.S. EPA in its National Toxics Rule (40 CFR 131.36). The National Toxics Rule allows states to use mixing zones to evaluate whether discharges comply with human health criteria.

The draft *Spokane River PCB Source Assessment 2003-2007* (Publication No. 11-03-013) identifies the various municipal discharges as sources of toxics such as PCBs to the Spokane River.

The draft source assessment estimates that a PCB load reduction in excess of 99% by all sources will be needed for compliances with the human health criterion for PCBs. The above effluent concentrations are from conventional secondary treatment. All three Washington municipal discharges will soon be employing tertiary treatment for phosphorus reduction including filtration. Further reduction of toxics, such as PCBs, is likely.

The permits for each NPDES discharger to the Washington section of the Spokane River has a narrative limit for PCBs requiring source identification, and control activities, establishment of performance based effluent limits leading to a long term goal of meeting applicable water quality standards. The permits also require the creation and participation in a Regional Toxics Task Force.

Not all toxicants of potential human health concern are not anticipated to be present, but periodic monitoring will be required to verify the absence of other human health toxicants.

Ecology evaluated the discharge's potential to violate the water quality standards as required by 40 CFR 122.44(d) by following the procedures published in the *Technical Support Document for Water Quality-Based Toxics Control* (EPA/505/2-90-001) and Ecology's *Permit Writer's Manual* to make a reasonable potential determination.

The evaluation showed that the discharge has no reasonable potential other than PCBs to cause a violation of water quality standards. A numeric effluent limit will be established based on plant performance in the next permit cycle. A plan for source control is needed (see V. Other Permit Conditions sections G & H).

H. Sediment Quality

The aquatic sediment standards (chapter 173-204 WAC) protect aquatic biota and human health. Under these standards Ecology may require a facility to evaluate the potential for its discharge to cause a violation of sediment standards (WAC 173-204-400). You can obtain additional information about sediments at the Aquatic Lands Cleanup Unit website at http://www.ecy.wa.gov/programs/tcp/smu/sediment.html.

Through a review of the discharger characteristics and of the effluent characteristics, Ecology determined that this discharge has no reasonable potential to violate the sediment management standards due to pollutant removal efficiency, stream velocity and a lack of particulates in the river and effluent for pollutants to absorb to.

I. Ground Water Quality Limits

The ground water quality standards (chapter 173-200 WAC) protect beneficial uses of ground water. Permits issued by Ecology must not allow violations of those standards (WAC 173-200-100).

The Spokane County Regional Water Reclamation Facility does not discharge wastewater to the ground. No permit limits are required to protect ground water.

IV. MONITORING REQUIREMENTS

Ecology requires monitoring, recording, and reporting (WAC 173-220-210 and 40 CFR 122.41) to verify that the treatment process is functioning correctly and that the discharge complies with the permit's effluent limits.

The monitoring schedule is detailed in the proposed permit under Condition S2. Specified monitoring frequencies take into account the quantity and variability of the discharge, the treatment method, past compliance, significance of pollutants, and cost of monitoring.

The required monitoring frequency is consistent with agency guidance given in the current version of Ecology's *Permit Writer's Manual* (Publication Number 92-09) for a tertiary activated sludge treatment plant discharging over 5 MGD.

Monitoring of sludge quantity and quality is necessary to determine the appropriate uses of the sludge. Biosolids monitoring is required by the current state and local solid waste management program and also by EPA under 40 CFR 503.

As a Pretreatment Publicly Owned Treatment Works (POTW), Spokane County Utilities is required to sample influent, primary clarifier effluent, final effluent, and sludge for toxic pollutants in order to characterize the industrial input. Sampling is also done to determine if pollutants interfere with the treatment process or pass-through the plant to the sludge or the receiving water. Spokane County Utilities will use the monitoring data to develop local limits which commercial and industrial users must meet.

A. Lab Accreditation

Ecology requires that facilities must use a laboratory registered or accredited under the provisions of chapter 173-50 WAC, *Accreditation of Environmental Laboratories* to prepare all monitoring data (with the exception of certain parameters). The plan for start up of the facility is to use a contract laboratory initially, tentatively Anatek Labs, Inc. Approximately 6 months after start up, the SCRWRF's on site laboratory would commence the Ecology accreditation protocols.

B. Receiving Water Monitoring

Ecology monitors the ambient water quality upstream and downstream of the SCRWRF outfall, but not in a location to distinguish any water quality impact of the county discharge from other outfalls. This permit will require the County to monitor the upstream and downstream water quality for a number of conventional parameters and metals in the second and fourth years of the permit.

C. Effluent Limits Which are Near Detection or Quantitation Levels

The water quality-based effluent concentration limits for total phosphorus are near the limits of current analytical methods to detect or accurately quantify.

The method detection level (MDL) is the minimum concentration of a pollutant that can be measured and reported with a 99 percent confidence that its concentration is greater than zero (as determined by a specific laboratory method). The quantitation level is the level at which concentrations can be reliably reported with a specified level of error.

Estimated concentrations are the values between the MDL and the QL. Ecology requires estimated concentrations to be reported.

When reporting maximum daily effluent concentrations, Ecology requires the facility to report "less than X" where X is the required detection level if the measured effluent concentration falls below the detection level. When calculating average monthly concentrations, the facility must use all the effluent concentrations measured below the quantitation level but above the method detection level. USEPA guidance states that when any sample analyzed in accordance with a method having the appropriate MDL and QL and found to be below the QL will be considered in compliance with the permit limits unless other monitoring information indicates a violation.

V. OTHER PERMIT CONDITIONS

A. Reporting and Record Keeping

Ecology based permit condition S3. on our authority to specify any appropriate reporting and record keeping requirements to prevent and control waste discharges (WAC 173-220-210).

B. Prevention of Facility Overloading

Overloading of the treatment plant is a violation of the terms and conditions of the permit. To prevent this from occurring, RCW 90.48.110 and WAC 173-220-150 requires Spokane County to take the actions detailed in proposed permit requirement S4. to plan expansions or modifications before existing capacity is reached and to report and correct conditions that could result in new or increased discharges of pollutants. Condition S4. restricts the amount of flow.

C. Operation and Maintenance (O&M)

The proposed permit contains Condition S5. as authorized under RCW 90.48.110, WAC 173-220-150, chapter 173-230 WAC, and WAC 173-240-080. Ecology included it to ensure proper operation and regular maintenance of equipment, and to ensure that Spokane County and CH2M Hill Constructors, Inc will take adequate safeguards so that it uses the constructed facilities to their optimum potential in terms of pollutant capture and treatment.

The proposed permit requires submission of an O&M manual.

D. Pretreatment

Duty to Enforce Discharge Prohibitions

The City of Spokane and Spokane County are Co-Permittees for the pretreatment sections of the City of Spokane's NPDES Permit for the Riverside Park Water Reclamation Facility.

The County's permit pretreatment section for its new water reclamation facility will therefore match the County's pretreatment section of the City's permit for which they are a Co-Permittee.

This pretreatment provision prohibits the POTW from authorizing or permitting an industrial discharger to discharge certain types of waste into the sanitary sewer.

A meeting was held on October 20, 2004 at the Department of Ecology Eastern Regional Office on the subject of Spokane-area pretreatment. The following are items that staff of the Department of Ecology, City of Spokane, Spokane County, and the City of Spokane Valley agreed upon pertaining to Delegated Pretreatment Programs in the Spokane area:

1) Spokane County has the authority to administer its Delegated Pretreatment Program to their present and future sewer customers located within their designated sewer service areas in Spokane County and in the City of Spokane Valley.

For the purpose of this meeting, this applies to customers who contribute wastewater into the Spokane County sewer collection system and are located outside of the corporate limits of the City of Spokane and within the City of Spokane Valley and Spokane County. Existing permitted facilities that this applies to are Ecolite Mfg Co., Galaxy Compound Semiconductors, Inc.; Honeywell Electronic Materials, Inc.; Lloyd Industries LLC, Kemira Water System, American On-Site Services and Novation, Inc. in the City of Spokane Valley, and the Mica Landfill in Spokane County.
The County acknowledges that as owner and operator of a wastewater collection system it has the responsibility to protect its infrastructure, and by agreement the infrastructure of the downstream POTW, and accepts the obligations of a Delegated Pretreatment Program. The City may through its Multi-Jurisdictional agreement request the County to serve select city customer's and exercise appropriate pretreatment authority over the discharger.

2) The City of Spokane has the authority to administer its delegated Pretreatment Program to their present and future sewer customers located within its designated sewer service areas in City of Spokane Valley, in Spokane County, and in the City of Spokane. For the purpose of this meeting, this applies to customers who contribute wastewater into the City of Spokane sewer collection system and are located either within or outside of the corporate limits of the City of Spokane. Existing permitted facilities that this applies to are Brenntag Pacific in the City of Spokane Valley, and Goodrich, Johnna Beverages, and Reliance Trailer in the West Plains Area of Spokane County. The City acknowledges that as owner and operator of a wastewater collection system and POTW it is their responsibility to protect their infrastructure, and accepts the obligations of a Delegated Pretreatment Program.

3) Both the City of Spokane and Spokane County, as the control authority for their Delegated Pretreatment Programs, will continue to enforce and update, if necessary and appropriate, their interlocal agreements and/or multijurisdictional pretreatment agreements with "contributing" jurisdictions such as Millwood, and Airway Heights. Some of these actions may include conducting Industrial User Surveys, monitoring, and permitting commercial and/or industrial users.

4) The agreements reached in the October 20, 2004 meeting are based upon individual and collective understanding of applicable laws, rules, regulations, and agreements pertaining to NPDES pretreatment requirements and programs in Washington State, and upon legal opinions provided by Spokane County and the City of Spokane Valley dated October 11, 2004 and October 12, 2004 respectively.

An industrial user survey is required to determine the extent of compliance of all industrial users of the sanitary sewer and wastewater treatment facility with federal pretreatment regulations (40 CFR Part 403 and Sections 307(b) and 308 of the Clean Water Act), with state regulations (Chapter 90.48 RCW and Chapter 173-216 WAC), and with local ordinances.

As sufficient data becomes available, the Permittees shall, in consultation with the Ecology, reevaluate their local limits in order to prevent pass through or interference. Upon determination by the Ecology that any pollutant present causes pass through or interference, or exceeds established sludge standards, the Permittees shall establish new local limits or revise existing local limits as required by 40 CFR 403.5.

In addition, Ecology may require revision or establishment of local limits for any pollutant that causes an exceedance of the Water Quality Standards or established effluent limits, or that causes whole effluent toxicity. The maximum effluent concentration reported in the City of Spokane's NPDES application does not exceed the reasonable potential criterion for mercury. However, Mercury in the Riverside Park Reclaimed Water Facilities effluent equaled or exceeded the chronic water quality criteria seven times from January 2002 through October 2004. It is Ecology's determination that the Permittees need to develop and implement a mercury abatement and control program. Additional Mercury Plan development guidance can be found at the following locations:

Ecology Mercury Website: http://www.ecy.wa.gov/mercury/
For Dental Plan Guidance: http://www.ecy.wa.gov/dentalbmps/index.html
Reduction Plan Guidance: http://www.ecy.wa.gov/biblio/0303001.html

Ecology may modify this permit to incorporate additional requirements relating to the establishment and enforcement of local limits for pollutants of concern

Requirements for Performing an Industrial User Survey

This POTW has the potential to serve significant industrial or commercial users and is required to perform an Industrial User Survey. The goal of this survey is to develop a list of SIUs and PSIUs, and of equal importance, to provide sufficient information about industries which discharge to the POTW, to determine which of them require issuance of State waste discharge permits or other regulatory controls. An Industrial User Survey is an important part of the regulatory process used to prevent interference with treatment processes at the POTW and to prevent the exceedance of water quality standards. The Industrial User Survey also can be used to contribute to the maintenance of sludge quality, so that sludge can be a useful biosolids product rather than an expensive waste problem.

An Industrial User Survey is a rigorous method for identifying existing, new, and proposed significant industrial users and potential significant industrial users. A complete listing of methodologies is available in Ecology's guidance document entitled "Conducting an Industrial User Survey".

- The first section of the pretreatment requirements prohibits the POTW from accepting pollutants which causes "Pass-through" or "Interference". This general prohibition is from 40 CFR §403.5(a). **Appendix C** of this fact sheet defines these terms.
- The second section reinforces a number of specific State and Federal pretreatment prohibitions found in WAC 173-216-060 and 40 CFR §403.5(b). These reinforce that the POTW may not accept certain wastes, which:
  - Are prohibited due to dangerous waste rules.
  - Are explosive or flammable.
  - Have too high or low of a pH (too corrosive, acidic or basic).
  - May cause a blockage such as grease, sand, rocks, or viscous materials.
  - Are hot enough to cause a problem.
  - Are of sufficient strength or volume to interfere with treatment.

- Contain too much petroleum-based oils, mineral oil, or cutting fluid.
- Create noxious or toxic gases at any point.

40 CFR Part 403 contains the regulatory basis for these prohibitions, with the exception of the pH provisions which are based on WAC 173-216-060.

- The third section of pretreatment conditions reflects state prohibitions on the POTW accepting certain types of discharges unless the discharge has received prior written authorization from Ecology.

  These discharges include:

  - Cooling water in significant volumes.
  - Stormwater and other direct inflow sources.
  - Wastewaters significantly affecting system hydraulic loading, which do not require treatment.

Ecology delegated authority to Spokane County Utilities for permitting, monitoring, and enforcement over industrial users discharging to their treatment system to provide more direct and effective control of pollutants.

Ecology oversees the delegated Industrial Pretreatment Program to assure compliance with federal pretreatment regulations (40 CFR Part 403) and categorical standards and state regulations (chapter 90.48 RCW and chapter 173-216 WAC).

As sufficient data becomes available, Spokane County Utilities must, in consultation with Ecology, reevaluate its local limits in order to prevent pass-through or interference. If any pollutant causes pass-through or interference, or exceeds established sludge standards, Spokane County Utilities must establish new local limits or revise existing local limits as required by 40 CFR 403.5.

In addition, Ecology may require revision or establishment of local limits for any pollutant that causes a violation of water quality standards or established effluent limits, or that causes whole effluent toxicity.

Ecology may modify this permit to incorporate additional requirements relating to the establishment and enforcement of local limits for pollutants of concern.

E. Solid Waste Control

To prevent water quality problems the facility is required in permit Condition S7. to store and handle all residual solids (grit, screenings, scum, sludge, and other solid waste) in accordance with the requirements of RCW 90.48.080 and state water quality standards.

The final use and disposal of sewage sludge from this facility is regulated by U.S. EPA under 40 CFR 503, and by Ecology under chapter 70.95J RCW, chapter 173-308 WAC “Biosolids Management,” and chapter 173-350 WAC “Solid Waste Handling Standards.” The disposal of other solid waste is under the jurisdiction of the Spokane County Health District.

Requirements for monitoring sewage sludge and record keeping are included in this permit. This information will be used by Ecology to develop or update local limits and is also required under 40 CFR 503.

F. Spill Plan

This facility stores a quantity of chemicals on-site that normally would have the potential to cause water pollution if accidentally released. Ecology can require a facility to develop best management plans to prevent this accidental release [Section 402(a)(1) of the Federal Water Pollution Control Act (FWPCA) and RCW 90.48.080]. However, the City of Spokane requires secondary containment of storage vessels and connections. Further best management plans are not necessary.

G. Toxic Source Control Action Plan

As described in III.C Anti-degradation and III.G Human Health, an action plan for identifying and controlling sources of toxics is needed. Known wastewater treatment technologies can not reduce influent PCBs adequately to meet current water quality standards for PCBs. What PCBs are removed are transferred to the biosolids which is less than an optimum option. Source control is essential.

- An Annual Toxics Management Report shall be prepared by the County and submitted to Ecology on an annual basis for review and evaluation on the PCB management effort. Activities planned for PCB reduction in the subsequent year of operation shall be jointly reviewed and agreed upon.
- The Toxics Management Plan is implementing a narrative effluent limit for PCBs. As such the Plan has 2 goals.
    - To reduce toxicant loadings, including PCBs, to the Spokane River to the maximum extent practicable realizing statistically significant reductions in the influent concentration of toxicants to the SCRWRF over the next 10 years.
    - Reduce PCBs in the effluent to the maximum extent practicable so that in time the effluent does not contribute to PCBs in the Spokane River exceeding applicable water quality standards.

H. Regional Toxics Task Force

During development of the proposed permit, the Spokane Riverkeeper expressed concerns about PCBs and water quality standards compliance to Spokane County.
As a result, Spokane County and the Spokane Riverkeeper put forth the idea of a Regional Toxics Task Force and offered up a number of ideas as to its functions and structure. While the initial concept was directed at PCBs as the primary toxicant, the River does have a 303(d) listing for dioxin in fish tissue. The Washington State Water Quality Standards do not have a criterion for PBDEs, but sampling by Ecology has shown elevated concentrations of PBDEs. PBDEs are now banned in some states, including Washington and presumably will be decreasing, but that was thought to be true of PCBs at one time.

The focus of the Task Force is appropriately on 303(d) listed toxics such as PCBs, however source identification and reduction efforts should not overlook opportunities to reduce the levels of PBDEs when possible.

The Spokane Tribe of Indians expressed very similar concerns. The tribal representatives are supportive of narrative limits with clearly stated goals (stated above).

Ecology does not want to be prescriptive regarding the organization and structure of a Task Force, but believes cooperative action is in the best interest of all stakeholders. Ecology also believes the time for action is now. Therefore, the rudiments of a Regional Toxics Task Force are described in the permit, but many details are left for the NPDES Permittees and other stakeholders to cooperatively develop.

The proposed permit does require the creation of a Regional Toxics Task Force and participation in it. The Task Force and Ecology's "Spokane River Toxics Reduction Strategy" are intended to avoid the need for a PCB TMDL and initiate source reduction and clean up actions sooner than if a TMDL came first. However, Ecology does have the obligation to use its regulatory authority to bring the river's water quality into compliance with applicable water quality standards. If the proposed Task Force approach is not successful, other means and methods will be employed including the option of a PCB TMDL.

It is anticipated that activities of the Task Force will begin with the following:

(1) Identify data gaps and collect necessary data on PCBs and other toxics on the 2008 year 303(d) list for the Spokane River;

(2) Further analyze the existing and future data to better characterize the amounts, sources, and locations of PCBs and other toxics on the 2008 year 303(d) list for the Spokane River;

(3) Prepare recommendations for controlling and reducing the sources of listed toxics in the Spokane River;

(4) Review proposed Toxic Management Plans, Source Management Plans, and BMPs;

(5) Monitor and assess the effectiveness of toxic reduction measures;

(6) Identify a mutually agreeable entity to serve as the clearinghouse for data, reports, minutes, and other information gathered or developed by the Task Force and its members. This information shall be made publicly available by means of a website and other appropriate means;

To accomplish the above tasks it is anticipated that the Task Force will need technical assistance in the person of an independent consultant.

Ecology, the US EPA Region X and Spokane Tribal representatives have conferred on this and are supportive of the Task Force creation and objectives.

For each Washington discharger to the Spokane River, Ecology is requiring prompt action on the concept and the proposed permit is requiring that:

(1) By **November 30, 2011**, the Permittee shall provide Ecology with the organizational structure, specific goals, funding and the governing documents of the Regional Toxics Task Force.

I. General Conditions

Ecology bases the standardized General Conditions on state and federal law and regulations. They are included in all individual municipal NPDES permits issued by Ecology.

VI. PERMIT ISSUANCE PROCEDURES

A. Permit Modifications

Ecology may modify this permit to impose numerical limits, if necessary to comply with water quality standards for surface waters, with sediment quality standards, or with water quality standards for ground waters, based on new information from sources such as inspections, effluent monitoring, outfall studies, and effluent mixing studies.

Ecology may also modify this permit to comply with new or amended state or federal regulations.

B. Proposed Permit Issuance

This proposed permit meets all statutory requirements for Ecology to authorize a wastewater discharge. The permit includes limits and conditions to protect human health and aquatic life, and the beneficial uses of waters of the state of Washington. Ecology proposes to issue this permit for a term of five (5) years.

VII. REFERENCES FOR TEXT AND APPENDICES

Environmental Protection Agency (EPA)

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1991. *Technical Support Document for Water Quality-based Toxics Control*. EPA/505/2-90-001.

1988. *Technical Guidance on Supplementary Stream Design Conditions for Steady State Modeling.* USEPA Office of Water, Washington, D.C.

1985. *Water Quality Assessment: A Screening Procedure for Toxic and Conventional Pollutants in Surface and Ground Water*. EPA/600/6-85/002a.

1983. *Water Quality Standards Handbook.* USEPA Office of Water, Washington, D.C.

Guidance on Water Quality Based Effluent Limits Set Below Analytical Detection/Quantitation Limits From: Cindi Godsey, NPDES Permits Unit To: NPDES Permits Unit Consistency Book dated April 25, 2005

Tsivoglou, E.C., and J.R. Wallace.

1972. *Characterization of Stream Reaeration Capacity*. EPA-R3-72-012. (Cited in EPA 1985 op.cit.)

Washington State Department of Ecology.

2006. *Permit Writer's Manual.* Publication Number 92-109 (http://www.ecy.wa.gov/biblio/92109.html)

Laws and Regulations (http://www.ecy.wa.gov/laws-rules/index.html)

Permit and Wastewater Related Information (http://www.ecy.wa.gov/programs/wq/wastewater/index.html)

Spokane River PCB Source Assessment 2003-2007, Publication No. 11-03-013

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1976. *Chlorination of Wastewater.*

Wright, R.M., and A.J. McDonnell.

1979. *In-stream Deoxygenation Rate Prediction.* Journal Environmental Engineering Division, ASCE. 105(EE2). (Cited in EPA 1985 op.cit.)

Spokane County Wastewater Facilities Plan Amendment – Revised Final Draft of December 2007 prepared by HDR

2010 Wastewater Facilities Plan Amendment prepared by HDR

Spokane County Regional Water Reclamation Facility PDD Update by CH2M Hill 9/24/2007, September 2008

Mixing Zone Study Report for the Proposed Spokane County Discharge to the Spokane River, Washington, Limno Tech, June 2004

Technical Memorandum *Task G102 – Mixing Zone and Water Quality Update* from Cosmopolitan Engineers to HDR Engineers representing Spokane County Utilities, dated October 29, 2007

Technical Memorandum: Water Quality Assessment of Alternate Spokane County Permit Limits, Limno Tech, March 11, 2010

Cadmium, Copper, Mercury, Lead and Zinc in the Spokane River, (Publication 94-09)

Final Draft *Spokane River PCB Source Assessment 2003-2007* (Publication No. 11-03-013)

APPENDIX A - PUBLIC INVOLVEMENT INFORMATION

Ecology proposes to issue a permit to the Spokane County Regional Water Reclamation Facility. The permit includes wastewater discharge limits and other conditions. This fact sheet describes the facility and Ecology's reasons for requiring permit conditions.

Ecology placed a Public Notice of Application on November 22, 2010 and November 29, 2010 in the Spokesman Review to inform the public about the submitted application and to invite comment on the issuance of this permit.

Ecology will place a Public Notice of Draft on June 28, 2011 in the Spokesman Review to inform the public and to invite comment on the proposed draft National Pollutant Discharge Elimination System permit and fact sheet.

The notice:

- Tells where copies of the draft permit and fact sheet are available for public.
- Offers to provide the documents in an alternate format to accommodate special needs.
- Asks people to tell us how well the proposed permit would protect the receiving water.
- Invites people to suggest fairer conditions, limits, and requirements for the permit.
- Invites comments on Ecology's determination of compliance with antidegradation rules.
- Urges people to submit their comments, in writing, before the end of the comment period.
- Tells how to request a public hearing about the proposed NPDES permit.
- Explains the next step(s) in the permitting process.

Ecology has published a document entitled *Frequently Asked Questions about Effective Public Commenting* which is available on our website at http://www.ecy.wa.gov/biblio/0307023.html.

You may obtain further information from Ecology by telephone at (509) 329-3519 or by writing to the address listed below.

Mr. Richard Koch
Department of Ecology
Eastern Regional Office
4601 North Monroe Street
Spokane, WA 99205-1295
rkoc461@ecy.wa.gov

The primary author of this permit and fact sheet is Richard A. Koch, P.E

APPENDIX B - YOUR RIGHT TO APPEAL

You have a right to appeal this permit to the Pollution Control Hearing Board (PCHB) within 30 days of the date of receipt of the final permit. The appeal process is governed by chapter 43.21B RCW and chapter 371-08 WAC. "Date of receipt" is defined in RCW 43.21B.001(2) (see glossary).

To appeal you must do the following within 30 days of the date of receipt of this permit:

- File your appeal and a copy of this permit with the PCHB (see addresses below). Filing means actual receipt by the PCHB during regular business hours.
- Serve a copy of your appeal and this permit on Ecology in paper form - by mail or in person. (See addresses below.) E-mail is not accepted.

You must also comply with other applicable requirements in chapter 43.21B RCW and chapter 371-08 WAC.

ADDRESS AND LOCATION INFORMATION

Street Addresses	Mailing Addresses
Department of Ecology Attn: Appeals Processing Desk 300 Desmond Drive SE Lacey, WA 98503 **Pollution Control Hearings Board** 1111 Israel RD SW STE 301 Tumwater, WA 98501	**Department of Ecology** Attn: Appeals Processing Desk PO Box 47608 Olympia, WA 98504-7608 **Pollution Control Hearings Board** PO Box 40903 Olympia, WA 98504-0903

APPENDIX C – GLOSSARY

1-DMax or 1-Day Maximum Temperature - The highest water temperature reached on any given day. This measure can be obtained using calibrated maximum/minimum thermometers or continuous monitoring probes having sampling intervals of thirty minutes or less.

7-DADMax or 7-Day Average of the Daily Maximum Temperatures - The arithmetic average of seven consecutive measures of daily maximum temperatures. The 7-DADMax for any individual day is calculated by averaging that day's daily maximum temperature with the daily maximum temperatures of the three days prior and the three days after that date.

Acute Toxicity - The lethal effect of a compound on an organism that occurs in a short time period, usually 48 to 96 hours.

AKART - The acronym for “all known, available, and reasonable methods of prevention, control and treatment.” AKART is a technology-based approach to limiting pollutants from wastewater discharges, which requires an engineering judgment and an economic judgment. AKART must be applied to all wastes and contaminants prior to entry into waters of the state in accordance with RCW 90.48.010 and 520, WAC 173-200-030(2)(c)(ii), and WAC 173-216-110(1)(a).

Alternate Point of Compliance - An alternative location in the ground water from the point of compliance where compliance with the ground water standards is measured. It may be established in the ground water at locations some distance from the discharge source, up to, but not exceeding the property boundary and is determined on a site specific basis following an AKART analysis. An “early warning value” must be used when an alternate point is established. An alternate point of compliance must be determined and approved in accordance with WAC 173-200-060(2).

Ambient Water Quality - The existing environmental condition of the water in a receiving water body.

Ammonia - Ammonia is produced by the breakdown of nitrogenous materials in wastewater. Ammonia is toxic to aquatic organisms, exerts an oxygen demand, and contributes to eutrophication. It also increases the amount of chlorine needed to disinfect wastewater.

Annual Average Design Flow (AADF) - Average of the daily flow volumes anticipated to occur over a calendar year.

Average Monthly Discharge Limit - The average of the measured values obtained over a calendar month's time.

Background Water Quality - The concentrations of chemical, physical, biological or radiological constituents or other characteristics in or of ground water at a particular point in time upgradient of an activity that has not been affected by that activity, [WAC 173-200-020(3)].

Background water quality for any parameter is statistically defined as the 95% upper tolerance interval with a 95% confidence based on at least eight hydraulically upgradient water quality samples. The eight samples are collected over a period of at least one year, with no more than one sample collected during any month in a single calendar year.

Best Management Practices (BMPs) - Schedules of activities, prohibitions of practices, maintenance procedures, and other physical, structural and/or managerial practices to prevent or reduce the pollution of waters of the state. BMPs include treatment systems, operating procedures, and practices to control: plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. BMPs may be further categorized as operational, source control, erosion and sediment control, and treatment BMPs.

BOD_5 - Determining the five-day Biochemical Oxygen Demand of an effluent is an indirect way of measuring the quantity of organic material present in an effluent that is utilized by bacteria. The BOD5 is used in modeling to measure the reduction of dissolved oxygen in receiving waters after effluent is discharged. Stress caused by reduced dissolved oxygen levels makes organisms less competitive and less able to sustain their species in the aquatic environment. Although BOD_5 is not a specific compound, it is defined as a conventional pollutant under the federal Clean Water Act.

Bypass - The intentional diversion of waste streams from any portion of a treatment facility.

Categorical Pretreatment Standards - National pretreatment standards specifying quantities or concentrations of pollutants or pollutant properties, which may be discharged to a POTW by existing or new industrial users in specific industrial subcategories.

Chlorine - A chemical used to disinfect wastewaters of pathogens harmful to human health. It is also extremely toxic to aquatic life.

Chronic Toxicity - The effect of a compound on an organism over a relatively long time, often 1/10 of an organism's lifespan or more. Chronic toxicity can measure survival, reproduction or growth rates, or other parameters to measure the toxic effects of a compound or combination of compounds.

Clean Water Act (CWA) - The federal Water Pollution Control Act enacted by Public Law 92-500, as amended by Public Laws 95-217, 95-576, 96-483, 97-117; USC 1251 et seq.

Compliance Inspection-Without Sampling - A site visit for the purpose of determining the compliance of a facility with the terms and conditions of its permit or with applicable statutes and regulations.

Compliance Inspection-With Sampling - A site visit for the purpose of determining the compliance of a facility with the terms and conditions of its permit or with applicable statutes and regulations.

In addition it includes as a minimum, sampling and analysis for all parameters with limits in the permit to ascertain compliance with those limits; and, for municipal facilities, sampling of influent to ascertain compliance with the 85 percent removal requirement. Ecology may conduct additional sampling.

Composite Sample - A mixture of grab samples collected at the same sampling point at different times, formed either by continuous sampling or by mixing discrete samples. May be "time-composite" (collected at constant time intervals) or "flow-proportional" (collected either as a constant sample volume at time intervals proportional to stream flow, or collected by increasing the volume of each aliquot as the flow increased while maintaining a constant time interval between the aliquots).

Construction Activity - Clearing, grading, excavation, and any other activity, which disturbs the surface of the land. Such activities may include road building; construction of residential houses, office buildings, or industrial buildings; and demolition activity.

Continuous Monitoring - Uninterrupted, unless otherwise noted in the permit.

Critical Condition - The time during which the combination of receiving water and waste discharge conditions have the highest potential for causing toxicity in the receiving water environment. This situation usually occurs when the flow within a water body is low, thus, its ability to dilute effluent is reduced.

Date of Receipt - This is defined in RCW 43.21B.001(2) as five business days after the date of mailing; or the date of actual receipt, when the actual receipt date can be proven by a preponderance of the evidence. The recipient's sworn affidavit or declaration indicating the date of receipt, which is unchallenged by the agency, constitutes sufficient evidence of actual receipt. The date of actual receipt, however, may not exceed forty-five days from the date of mailing.

Detection Limit - See Method Detection Level.

Dilution Factor (DF) - A measure of the amount of mixing of effluent and receiving water that occurs at the boundary of the mixing zone. Expressed as the inverse of the percent effluent fraction, for example, a dilution factor of 10 means the effluent comprises 10% by volume and the receiving water 90%.

Distribution Uniformity - The uniformity of infiltration (or application in the case of sprinkle or trickle irrigation) throughout the field expressed as a percent relating to the average depth infiltrated in the lowest one-quarter of the area to the average depth of water infiltrated.

Early Warning Value - The concentration of a pollutant set in accordance with WAC 173-200-070 that is a percentage of an enforcement limit. It may be established in the effluent, ground water, surface water, the vadose zone or within the treatment process. This value acts as a trigger to detect and respond to increasing contaminant concentrations prior to the degradation of a beneficial use.

Enforcement Limit - The concentration assigned to a contaminant in the ground water at the point of compliance for the purpose of regulation, [WAC 173-200-020(11)]. This limit assures that a ground water criterion will not be exceeded and that background water quality will be protected.

Engineering Report - A document that thoroughly examines the engineering and administrative aspects of a particular domestic or industrial wastewater facility. The report must contain the appropriate information required in WAC 173-240-060 or 173-240-130.

Fecal Coliform Bacteria - Fecal coliform bacteria are used as indicators of pathogenic bacteria in the effluent that are harmful to humans. Pathogenic bacteria in wastewater discharges are controlled by disinfecting the wastewater. The presence of high numbers of fecal coliform bacteria in a water body can indicate the recent release of untreated wastewater and/or the presence of animal feces.

Grab Sample - A single sample or measurement taken at a specific time or over as short a period of time as is feasible.

Ground Water - Water in a saturated zone or stratum beneath the surface of land or below a surface water body.

Industrial User - A discharger of wastewater to the sanitary sewer that is not sanitary wastewater or is not equivalent to sanitary wastewater in character.

Industrial Wastewater - Water or liquid-carried waste from industrial or commercial processes, as distinct from domestic wastewater. These wastes may result from any process or activity of industry, manufacture, trade or business; from the development of any natural resource; or from animal operations such as feed lots, poultry houses, or dairies. The term includes contaminated storm water and, also, leachate from solid waste facilities.

Interference - A discharge which, alone or in conjunction with a discharge or discharges from other sources, both:

- Inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal; and
- Therefore is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued thereunder (or more stringent State or local regulations): Section 405 of the Clean Water Act, the Solid Waste Disposal Act (SWDA) (including title II, more commonly referred to as the Resource Conservation and Recovery Act (RCRA), and including State regulations contained in any State sludge management plan prepared pursuant to subtitle D of the SWDA), sludge regulations appearing in 40 CFR Part 507, the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection, Research and Sanctuaries Act.

Local Limits - Specific prohibitions or limits on pollutants or pollutant parameters developed by a POTW.

Major Facility - A facility discharging to surface water with an EPA rating score of > 80 points based on such factors as flow volume, toxic pollutant potential, and public health impact.

Maximum Daily Discharge Limit - The highest allowable daily discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. The daily discharge is calculated as the average measurement of the pollutant over the day.

Maximum Day Design Flow (MDDF) **-** The largest volume of flow anticipated to occur during a one-day period, expressed as a daily average.

Maximum Month Design Flow (MMDF) - The largest volume of flow anticipated to occur during a continuous 30-day period, expressed as a daily average.

Maximum Week Design Flow (MWDF) - The largest volume of flow anticipated to occur during a continuous 7-day period, expressed as a daily average.

Method Detection Level (MDL) - The minimum concentration of a substance that can be measured and reported with 99 percent confidence that the pollutant concentration is above zero and is determined from analysis of a sample in a given matrix containing the pollutant.

Minor Facility - A facility discharging to surface water with an EPA rating score of < 80 points based on such factors as flow volume, toxic pollutant potential, and public health impact.

Mixing Zone - An area that surrounds an effluent discharge within which water quality criteria may be exceeded. The permit specifies the area of the authorized mixing zone that Ecology defines following procedures outlined in state regulations (chapter 173-201A WAC).

National Pollutant Discharge Elimination System (NPDES) - The NPDES (Section 402 of the Clean Water Act) is the federal wastewater permitting system for discharges to navigable waters of the United States. Many states, including the state of Washington, have been delegated the authority to issue these permits. NPDES permits issued by Washington State permit writers are joint NPDES/State permits issued under both state and federal laws.

pH - The pH of a liquid measures its acidity or alkalinity. It is the negative logarithm of the hydrogen ion concentration. A pH of 7 is defined as neutral and large variations above or below this value are considered harmful to most aquatic life.

Pass-Through - A discharge which exits the POTW into waters of the State in quantities or concentrations which, alone or in conjunction with a discharge or discharges from other sources, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation), or which is a cause of a violation of State water quality standards.

Peak Hour Design Flow (PHDF) - The largest volume of flow anticipated to occur during a one-hour period, expressed as a daily or hourly average.

Peak Instantaneous Design Flow (PIDF) - The maximum anticipated instantaneous flow.

Point of Compliance - The location in the ground water where the enforcement limit must not be exceeded and a facility must comply with the Ground Water Quality Standards. Ecology determines this limit on a site-specific basis. Ecology locates the point of compliance in the ground water as near and directly downgradient from the pollutant source as technically, hydrogeologically, and geographically feasible, unless it approves an alternative point of compliance.

Potential Significant Industrial User (PSIU) - A potential significant industrial user is defined as an Industrial User that does not meet the criteria for a Significant Industrial User, but which discharges wastewater meeting one or more of the following criteria:

a. Exceeds 0.5 % of treatment plant design capacity criteria and discharges <25,000 gallons per day or;
b. Is a member of a group of similar industrial users which, taken together, have the potential to cause pass through or interference at the POTW (e.g. facilities which develop photographic film or paper, and car washes).
   Ecology may determine that a discharger initially classified as a potential significant industrial user should be managed as a significant industrial user.

Quantitation Level (QL) - Also known as Minimum Level of Quantitation (ML) – The lowest level at which the entire analytical system must give a recognizable signal and acceptable calibration point for the analyte. It is equivalent to the concentration of the lowest calibration standard, assuming that the lab has used all method-specified sample weights, volumes, and cleanup procedures. The QL is calculated by multiplying the MDL by 3.18 and rounding the result to the number nearest to (1,2,or 5) x 10^n, where n is an integer. (64 FR 30417).
ALSO GIVEN AS:
The smallest detectable concentration of analyte greater than the Detection Limit (DL) where the accuracy (precision & bias) achieves the objectives of the intended purpose. (Report of the Federal Advisory Committee on Detection and Quantitation Approaches and Uses in Clean Water Act Programs Submitted to the US Environmental Protection Agency December 2007).

Reasonable Potential - A reasonable potential to cause a water quality violation, or loss of sensitive and/or important habitat.

Responsible Corporate Officer - A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or have gross annual sales or expenditures exceeding $25 million (in second quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures (40 CFR 122.22).

Significant Industrial User (SIU) -

1) All industrial users subject to Categorical Pretreatment Standards under 40 CFR 403.6 and 40 CFR Chapter I, Subchapter N and;
2) Any other industrial user that: discharges an average of 25,000 gallons per day or more of process wastewater to the POTW (excluding sanitary, noncontact cooling, and boiler blow-down wastewater); contributes a process wastestream that makes up 5 percent or more of the average dry weather hydraulic or organic capacity of the POTW treatment plant; or is designated as such by the Control Authority* on the basis that the industrial user has a reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement [in accordance with 40 CFR 403.8(f)(6)].
   Upon finding that the industrial user meeting the criteria in paragraph 2, above, has no reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement, the Control Authority* may at any time, on its own initiative or in response to a petition received from an industrial user or POTW, and in accordance with 40 CFR 403.8(f)(6), determine that such industrial user is not a significant industrial user.
   *The term "Control Authority" refers to the Washington State Department of Ecology in the case of non-delegated POTWs or to the POTW in the case of delegated POTWs.

Slug Discharge - Any discharge of a non-routine, episodic nature, including but not limited to an accidental spill or a non-customary batch discharge to the POTW. This may include any pollutant released at a flow rate that may cause interference or pass through with the POTW or in any way violate the permit conditions or the POTW's regulations and local limits.

Soil Scientist - An individual who is registered as a Certified or Registered Professional Soil Scientist or as a Certified Professional Soil Specialist by the American Registry of Certified Professionals in Agronomy, Crops, and Soils or by the National Society of Consulting Scientists or who has the credentials for membership. Minimum requirements for eligibility are: possession of a baccalaureate, masters, or doctorate degree from a U.S. or Canadian institution with a minimum of 30 semester hours or 45 quarter hours professional core courses in agronomy, crops or soils, and have 5,3,or 1 years, respectively, of professional experience working in the area of agronomy, crops, or soils.

Solid Waste - All putrescible and non-putrescible solid and semisolid wastes including, but not limited to, garbage, rubbish, ashes, industrial wastes, swill, sewage sludge, demolition and construction wastes, abandoned vehicles or parts thereof, contaminated soils and contaminated dredged material, and recyclable materials.

Soluble BOD_5 - Determining the soluble fraction of Biochemical Oxygen Demand of an effluent is an indirect way of measuring the quantity of soluble organic material present in an effluent that is utilized by bacteria. Although the soluble BOD_5 test is not specifically described in Standard Methods, filtering the raw sample through at least a 1.2 um filter prior to running the standard BOD_5 test is sufficient to remove the particulate organic fraction.

State Waters - Lakes, rivers, ponds, streams, inland waters, underground waters, salt waters, and all other surface waters and watercourses within the jurisdiction of the state of Washington.

Stormwater - That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes, and other features of a storm water drainage system into a defined surface water body, or a constructed infiltration facility.

Technology-Based Effluent Limit - A permit limit based on the ability of a treatment method to reduce the pollutant.

Total Coliform Bacteria - A microbiological test, which detects and enumerates the total coliform group of bacteria in water samples.

Total Dissolved Solids (TDS) - That portion of total solids in water or wastewater that passes through a specific filter.

Total Suspended Solids (TSS) - Total suspended solids is the particulate material in an effluent. Large quantities of TSS discharged to a receiving water may result in solids accumulation. Apart from any toxic effects attributable to substances leached out by water, suspended solids may kill fish, shellfish, and other aquatic organisms by causing abrasive injuries and by clogging the gills and respiratory passages of various aquatic fauna. Indirectly, suspended solids can screen out light and can promote and maintain the development of noxious conditions through oxygen depletion.

Upset - An exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limits because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, lack of preventative maintenance, or careless or improper operation.

Water Quality-Based Effluent Limit - A limit imposed on the concentration of an effluent parameter to prevent the concentration of that parameter from exceeding its water quality criterion after discharge into receiving waters.

APPENDIX D – TECHNICAL CALCULATIONS

Several of the Excel® spreadsheet tools used to evaluate a discharger's ability to meet Washington State water quality standards can be found on Ecology's homepage at http://www.ecy.wa.gov/programs/eap/pwspread/pwspread.html.

Effluent and Receiving Water Critical Conditions

Facility:	**SCRWRF**			Design Case:	**Reasonable Potential - low flo**		
Receiving Water:	**Spokane River above Green St**						
	Effluent Data			**Receiving Water Data**			
CLICK HERE FOR INSTRUCTIONS	Annual Average Flow	Monthly Average Flow	Daily Maximum Flow	7Q10 Critical Flow	30Q5 Critical Flow	Harmonic Mean Flow	%flow for dilution
Flow (MGD)	**8.00**	**8.50**	**12.00**	370.33	518.46	1110.99	**25**
(cfs)	12.38	13.15	18.57	**573.00**			

Critical Temp (1DMax or 7DADMax) °C	**20.00**	Effluent Data ←		**18.10**	Receiving Water Data ←	
(°F)	68.0			64.6		
Critical Hardness (mg/L CaCO3)	**120.00**			**56.50**		
Critical pH (s.u.)	**7.00**			**8.06**		
Critical Alkalinity (mg/L as CaCO3)	**100.00**			**55.00**		

Enter own pH & Temp for Ammonia Criteria?	**n**		Enter own Dilution Factors (DFs)?		**n**
	pH	Temp (°C)		Acute DF	
@ Acute Boundary				Chronic DF	
@ Chronic Boundary				Human Health (non C) DF	
				Human Health (Carcn) DF	

	@ Acute Boundary	@ Chronic Boundary	Whole River Dilution (@ 7Q10 Flow)	@ 30Q5 River Flow (non C)	@Harmonic Mean River Flow (Carcn)
Dilution Factor	1.77	11.89	44.57	16.25	35.72
(% effluent)	56.45	8.41	2.24	6.15	2.80
Hardness	92.34	61.84	57.92	-	-
Alkalinity	80.40	58.78	56.01	-	-
Max pH (s.u.)	7.14	7.67	7.91	-	-
Max Temp (°C)	19.17	18.26	18.14	-	-
Max Temp (°F)	66.51	64.87	64.66	-	-

Pollutant, Effluent, and Receiving Water Data

Facility	SCRWRF
Receiving Water	Spokane River above Green St
Design Case	Reasonable Potential - low flow

			Freshwater Quality Criteria		Metals Translators			Enter Effluent Data					Enter RW Data
Pollutant, CAS No. & Application Ref. No.	priority pollutant?	standard	acute ug/L	chronic ug/L	acute	chronic	Probability (0.95 - WQ Based; 0.5 - Human Health)	max effluent concentration (measured) ug/L	# of data points	Coefficient of Varation	#samples per month for compliance monitoring	50% percentile effluent conc for HH RPD, when n>10 (leave blank otherwise) ug/L	Ambient Concentration ug/L
AMMONIA unionized	N	WQ Stnd	21061.6	1689.4	0.0	0.0	0.95	**8.0**	**12**	**0.6**	**12**		**0.02**

Summary of Effluent Reasonable Potential Determination & Limits												Facility: SCRWRF; Receiving Water: Spokane River above Green St; Design Case: Reasonable Potential - low flow	
					Receiving Water	Acute Boundary		Chronic Boundary		Permit Limits	
POLLUTANT	priority pollutant?	standard	Maximum Expected (or 50%) Effluent Concentration, µg/L	Does reasonable potential exist?	Upstream RW Conc, µg/L	RW Acute Criteria, µg/L	Conc @ Acute MZ Boundary, µg/L	RW Chronic (or Human Health) Criteria, µg/L	Conc @ Chronic (or Human Health) MZ Boundary, µg/L	Daily Maximum Limit, µg/L	Monthly Average Limit, µg/L
AMMONIA unionized	N	WQ Stnd	13.0	NO	0.02	21061.6	7.348	1689.4	1.112		

APPENDIX E – RESPONSE TO COMMENTS

The public notice that informed the public that a draft permit was available for review was published in the Spokesman Review on June 28, 2011. Ecology received comments on the draft permit following the 30-day public comment period. All comments and Ecology's responses are attached to this fact sheet as Attachment A.

APPENDIX F – REVISED TECHNICAL CALCULATIONS

Several of the Excel® spreadsheet tools used to evaluate a discharger's ability to meet Washington State water quality standards can be found on Ecology's homepage at http://www.ecy.wa.gov/programs/eap/pwspread/pwspread.html.

Commenter on the fact sheet noted a data entry mistake. The entry for maximum effluent concentration should have been 8000 ug/L instead of 8 ug/L. The corrected reasonable potential calculation for ammonia follows:

Pollutant, Effluent, and Receiving Water Data

Facility: SCRWRF
Receiving Water: Spokane River above Green St
Design Case: Reasonable Potential - low flow

			Freshwater Quality Criteria		Metals Translators			Enter Effluent Data					Enter RW Data
Pollutant, CAS No. & Application Ref. No.	priority pollutant?	standard	acute	chronic	acute	chronic	Probability (0.95 - WQ Based; 0.5 - Human Health)	max effluent concentration (measured)	# of data points	Coefficient of Varation	#samples per month for compliance monitoring	50% percentile effluent conc for HH RPD, when n>10 (leave blank otherwise)	Ambient Concentration
			ug/L	ug/L				ug/L				ug/L	ug/L
AMMONIA unionized	N	WQ Stnd	21061.6	1689.4	0.0	0.0	0.95	8000.0	12	0.6	12		0.02

Summary of Effluent Reasonable Potential Determination & Limits

Facility: SCRWRF
Receiving Water: Spokane River above Green St
Design Case: Reasonable Potential - low flow

					Receiving Water	Acute Boundary		Chronic Boundary		Permit Limits	
POLLUTANT	priority pollutant?	standard	Maximum Expected (or 50%) Effluent Concentration, µg/L	Does reasonable potential exist?	Upstream RW Conc, µg/L	RW Acute Criteria, µg/L	Conc @ Acute MZ Boundary, µg/L	RW Chronic (or Human Health) Criteria, µg/L	Conc @ Chronic (or Human Health) MZ Boundary, µg/L	Daily Maximum Limit, µg/L	Monthly Average Limit, µg/L
AMMONIA unionized	N	WQ Stnd	13001.5	NO	0.02	21061.6	7339.2	1689.4	1093.3		

APPENDIX G

Guidance on Water Quality Based Effluent Limits Set Below Analytical Detection/Quantitation Limits

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, WA 98101

April 25, 2005

MEMORANDUM

SUBJECT: Guidance on Water Quality Based Effluent Limits Set Below Analytical Detection/Quantitation Limits

FROM: Cindi Godsey, NPDES Permits Unit
Michael Lidgard, Manager, NPDES Permits Unit
Kim Ogle, Manager, NPDES Compliance Unit

TO: NPDES Permits Unit Consistency Book

The purpose of this memorandum is to provide guidance to EPA Region 10 permit writers and compliance staff, for permitting, monitoring, and enforcement of water quality-based effluent limits set below the analytical detection/quantitation limit. This guidance is for effluent limits that are greater than zero but less than the minimum level (ML).

NPDES permits must include the water quality based effluent limit regardless of the proximity of the limit to the analytical detection level. Where the effluent limit concentration is below the analytical detection level for the pollutant of concern the following is recommended:

- The NPDES permit should include the most sensitive Method Detection Level (MDL) from an EPA approved analytical test method necessary for compliance monitoring. The analytical test method should be approved under 40 CFR 136, or other appropriate method if one is not available under 40 CFR 136. The permit should also identify the ML as the compliance level.

- The NPDES permit should state that any sample analyzed in accordance with a method having the appropriate MDL and ML and found to be below the ML will be considered in compliance with the permit limits unless other monitoring information indicates a violation.

- The permit should specify how samples should be reported. Suggested language: For purposes of reporting on the DMR for a single sample, if a value is less than the MDL, the permittee must report “less than {numeric value of the MDL}” and if a value is less than the ML, the permittee must report “less than {numeric value of the ML}.”

Where more than one sample is being considered, the permit should specify how effluent samples below the ML should be utilized for purposes of averaging. Suggested language: For purposes of calculating monthly averages, zero may be assigned for values less than the MDL, the {numeric value of the MDL} may be assigned for values between the MDL and the ML. If the average value is less than the MDL, the permittee must report "less than {numeric value of the MDL}" and if the average value is less than the ML, the permittee must report "less than {numeric value of the ML}." If a value is equal to or greater than the ML, the permittee must report and use the actual value. The resulting average value must be compared to the compliance level, the ML, in assessing compliance.

- Special conditions should be included in the permit which help ensure that the limits are being met and that excursions above water quality standards are not occurring. Special conditions could include: fish tissue sampling, sediment monitoring, limits/monitoring on internal wastestreams, or limits/monitoring for surrogate parameters.

RATIONALE

EPA's recommended approach in the *Technical Support Document for Water Quality-based Toxics Control*, EPA, March 1991 (TSD, chapter 5, section 5.7.3), includes:

- The NPDES permit should include the most sensitive analytical test method that should be used for compliance monitoring. The analytical test method should be approved under 40 CFR 136, or other appropriate method if one is not available under 40 CFR 136.

- The NPDES permit should state that any sample analyzed in accordance with the specified method and found to be below the compliance level will be considered in compliance with the permit limit unless other monitoring information indicates a violation.

- Sample results at or above the ML should be reported as the observed concentrations whereas sample results below the compliance level should be reported as less than this level.

- The compliance level cited in the permit must be clearly defined and quantified. For most NPDES permitting situations, EPA recommends that the compliance level be defined in the permit as the ML. The ML is the level at which the entire analytical system gives recognizable mass spectra and acceptable calibration points.

- Special conditions should be included in the permit which help ensure that the limits are being met and that excursions above water quality standards are not occurring. Special conditions could include: fish tissue sampling, limits/monitoring on internal wastestreams, or limits/monitoring for surrogate parameters.

The TSD does not recommend an approach for averaging multiple sample results below the ML. However, a memorandum entitled *Questions and Answers on the Great Lakes Water Quality Guidance, Set 2* (March 20,1996; James Hanlon, Deputy Director of the Office of Science and Technology), states:

> In the case of determining compliance with average limitations, permitting authorities shall use applicable State and Tribal procedures to average and account for monitoring data (see Procedure 8, Section A.4) and, ... Permitting authority may have various approaches for specifying how effluent samples below the LOQ should be regarded for purposes of averaging (e.g., equal to zero, equal to one-half the LOQ, etc.).

DEFINITIONS

Limit of quantization means the smallest amount of chemical that can be reliably quantitated.

Method Detection Limit means the minimum concentration of a substance (analyte) that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte (see 40 CFR 136 Appendix B).

Minimum Level means the concentration at which the entire analytical system must give a recognizable signal and an acceptable calibration point. The ML is the concentration in a sample that is equivalent to the concentration of the lowest calibration standard analyzed by a specific analytical procedure, assuming that all the method-specified sample weights, volumes and processing steps have been followed (*Technical Support Document for Water Quality-based Toxics Control*, EPA, March 1991).

3/6/01

Total Maximum Daily Load

PCB and Chlordane

Ohio River

From the Point in Pittsburgh to the State Border

Beaver, Lawrence, Washington and Allegheny Counties

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Appendix A - STORET retrieval of PCB and chlordane fish tissue data

Appendix B – Comment and Response

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Introduction

Pennsylvania has conducted monitoring of fish tissue contaminants since 1976. Early efforts were comprised of special studies in major water-bodies as well as smaller waters with suspected sources of contaminants. Routine sampling for tissue contaminants began in 1979 with implementation of the EPA "CORE" monitoring network that mandated collection of whole fish samples. Because Pennsylvania wanted the fish tissue monitoring program to focus on protection of public health, we began sampling both the edible portion and whole body at one-half of the stations. In 1987, Pennsylvania began sampling the edible portion almost exclusively. In order to increase spatial coverage, the Department also began rotating sampling through its routine ambient monitoring network and provided both Department of Environmental Protection (DEP) and Fish and Boat Commission field biologists the opportunity to sample suspected problem areas.

Fishing is a wholesome, relaxing pastime, and fish are nutritious and good to eat. Some fish, however, may accumulate contaminants to levels that may be harmful to those who eat them over a long period of time. In an attempt to protect public health, the Commonwealth periodically (at least annually) issues fish consumption advisories based on monitoring data from a number of sources. Advisories are issued jointly by the Department of Health, the Fish and Boat Commission, and DEP. The list of advisories is published in the "Pennsylvania Summary of Fishing Regulations and Laws" which is provided to each fishing license buyer, and is also available from the Department in hard copy and through the Internet at http://www.dep.state.pa.us. In addition, the annual list and any individual advisories needed between lists are issued using press releases.

A number of Pennsylvania water bodies with fish consumption advisories were listed on the Clean Water Act Section 303(d) List of Impaired Waters for 1996. They were listed because long-term, unrestricted consumption of these fish could potentially lead to human health problems. This document addresses contamination of fish tissue in the Ohio River, Beaver Lawrence, Washington, and Allegheny Counties by PCB and chlordane.

Background

This Total Maximum Daily Load (TMDL) applies to the Ohio River (Stream Code 32317) from the point in Pittsburgh to the State border, listed in Basins 20-B, D and G (RMI 981 to 941). The River Mile and the Segment Id for the 303(d) List are as follows:

The point in Pittsburgh to Beaver River ID 9917 [20-G] RMI 981 – 955.5
The point from Beaver River and Raccoon Creek ID 9918 [20-B] RMI 955.5-949.29
The point from Raccoon Creek to Montgomery Dam ID 9918 [20-B] RMI 949.29-948
The point from Montgomery Dam to Ohio/PA State Line ID 9918 [20-D] RMI948-940.74

The Ohio River was included on the 1998 Section 303(d) list [with IDs 9917 and 9918] as a high priority for TMDL development. It should be noted that in the 1996 303(d) List SWP 20-E designation as a low priority was erroneous.

The first advisory for Ohio River was issued on December 12, 1979. The public was warned not to eat carp taken near Brunot Island due to PCB contamination (6.0 ppm). A statewide release on June 26, 1986 included the same advice for carp at the Dashields and Montgomery Locks and Dams due to chlordane levels of 0.40 ppm and 0.28 respectively, and for channel catfish at Dashields due to PCB concentrations of 2.45 and 3.43 ppm respectively. These advisories were re-issued a number of times in cooperation with ORSANCO and other states. The carp and channel catfish advice remained generally unchanged until application of the Great Lakes protocol for 1998. At that time, the downstream segment limit was changed to the Montgomery Lock and Dam. The 1998 “Do Not Eat” advice remains for carp and channel catfish. Since implementation of the Great Lakes protocol, the public is advised to eat no more than one meal per month (Group 3) of walleye, sauger, white bass and freshwater drum from the point in Pittsburgh to the Mongomery Lock and Dam (RM 31.2). The advisory issued by Ohio and West Virginia is in place for the remainder of the main stem Ohio River in Pennsylvania. In this reach, one meal per week is given for largemouth bass, small mouth bass, spotted bass and sauger. One meal per month advice applies to white bass, hybrid striped badd and freshwater drum. Flathead catfish and channel catfish are limited to six meals per year.

TMDL Development

Endpoint Identification

The overall goal of a TMDL is to achieve the "fishable/swimmable" goal of the federal Clean Water Act. Because consumption advisories are in place for a number of species for PCB and chlordane, these goals are not being met in this segment of the Ohio River.

The specific goal of a TMDL is to outline a plan to achieve water quality standards in the water body. For this segment of the Ohio River, the TMDL goal is for levels of PCB and chlordane in the water column to be equal to or less than the Commonwealth's water quality criteria. The criteria, found in the "Water Quality Toxics Management Strategy - Statement of Policy" (Chapter 16 of the Department's rules and regulations) are 0.00004 ug/L (micrograms per liter, equivalent to parts per billion) for PCB and 0.0005 ug/L for chlordane. Both of these compounds are probable human carcinogens, and these are human health criteria developed to protect against excess cancer risk. Specifically, the Department's water quality toxics management program controls carcinogens to an overall risk management level of one excess case of cancer in a population of 1 million (1×10^{-6}). Expressing this another way, the probability of an individual getting cancer is increased by a factor of 1 in 1 million.

Two means were employed in an effort to obtain readily available data on instream PCB and chlordane levels for comparison to the criteria. First, the Department's Southwest Field Office searched for PCB and chlordane data in or upstream from the Ohio River fish consumption advisory segment. Second, data from the EPA Storage and Retrieval System (STORET) was obtained. An "Inventory" retrieval that would include data collected by all agencies using STORET was run for all areas around the Department's fish tissue sampling stations. For the Ohio River, the search was conducted using a six-mile radius around Water Quality Network Station 902 and a 15-mile radius around the fish tissue sampling station just below the Montgomery Lock and Dam. This station is WQF32317-032.0 (Ohio River at Montgomery Lock and Dam) and WQN Station # 902 (Ohio River at RMI 969.2 miles; Bridge off SR4025 in Allegheny County). No water column data were found near Montgomery. A number of data points collected at WQN Station # 902 (1970 and 1977) and at Montgomery (1970 and 1979) were found. All samples were less than detection except for one sample that showed PCB 1260 at 0.4 ug/l. In any event, these data do not represent current conditions.

As a means to compare current conditions to the water quality criteria, an estimated water column concentration was calculated based on the fish tissue concentrations and bioconcentration factors. The calculation involves dividing the average fish tissue concentration by the bioconcentration factor to obtain a projected water column concentration.

The equation is:

$$\frac{TC}{BCF} = WC \times 1000, \text{ where}$$

TC = Tissue Concentration in mg/kg (equivalent to mg/L)
BCF = EPA Bioconcentration Factor in L/kg
WC = Water Column Concentration (estimated) in mg/L
(multiply by 1000 to obtain (ug/L)

The average fish tissue concentration is the mean of all samples shown in the table below. A Storet data retrieval of all the PCB and chlordane fish tissue data for all the fish tissue sampling stations on the Ohio River are included in Appendix A. The average concentration is used for two main reasons. First, the fish tissue samples are composites. This means that the sample result represents the average tissue concentration in three to five individuals, and not an exact value. Second, use of an average value considers the natural variation in tissue burden found in wild fish populations. The PCB bioconcentration factor (BCF) of 31,200 from the EPA criteria development document (EPA 440/5-80-068, October 1980) was used. The chlordane BCF of 14,100 from the EPA criteria development document (EPA 440/5-80-027, October 1980) was applied. These BCFs were used because no Bioaccumulation Factors (BAFs) are available for statewide use. The use of the BCFs is consistent with the provisions of the Department's water quality toxics management strategy. Average PCB and chlordane tissue levels were determined for each species using all samples. An estimated water column concentration was then calculated for each compound for each species. These estimated water column concentrations were averaged for each compound in order to provide a single estimated water column concentration for each parameter for the segment.

Fish Tissue Data Used to calculate the TMDL for the Ohio River

Parameter	Fish Species	Number of Data Sets	Range of Years	Years
PCB	Walleye	4	1988 - 1997	1988, 1991, 1992, 1997
	White Bass	2	1989 - 1995	1989, 1995
	Drum	2	1990 - 1997	1990, 1997
	Carp	13	1985 - 1994	1985, 1988, 1989, 1990, 1991, 1992, 1994, 1995, 1997
	Channel Cat	22	1988 - 1997	1988, 1989, 1990, 1991, 1992, 1994, 1995, 1997
Chlordane	Carp	13	1985 - 1994	1985, 1988, 1989, 1990, 1991, 1992, 1994, 1995, 1997
	Channel Cat	22	1988 - 1997	1988, 1989, 1990, 1991, 1992, 1994, 1995, 1997

The average PCB levels in the Ohio River segment are carp – 2.14 mg/kg; walleye and sauger mg/kg –0.605; white bass – 0.735; freshwater drum –0.740 and channel catfish - 2.92 mg/kg. The estimated concentration of PCB in the water column is 0.04577 ug/L. The average chlordane concentration in carp is 0.24 mg/kg and channel catfish is 0.276 mg/kg. The corresponding estimated water column concentration for chlordane is 0.01830 ug/L.

These estimated concentrations exceed the applicable water quality criteria. These values most likely do not represent the actual existing instream concentrations due to the basis for the back-calculation. The back-calculations from tissue level to water column concentration were performed using data on species for which consumption advisories have been issued, i.e., fish with elevated tissue levels of these compounds. It must also be noted that the average tissue concentrations may be artificially elevated because of the use of one-half of the detection limit for data reported as less than detection. The actual concentration could lie anywhere between zero and the detection limit. The use of one-half of the detection limit is merely a means of obtaining a reasonable value to use in calculating the average. While the actual concentrations in the water column are not known, they are likely to be lower than the calculated estimates.

Source Assessment

The production and use of PCB in the United States was banned in July of 1979. While it is now illegal to manufacture, distribute, or use PCB in the United States, these synthetic oils were used in the past as insulating fluids in electrical transformers and other products, as cutting oils, and in carbonless paper. PCB was introduced into the environment while use was unrestricted, and occasional releases still occur. In addition, some permitted discharges and Superfund sites contribute PCB to surface water. Once in a waterbody, PCB becomes associated with solids particles and enters the sediments. PCB is very resistant to breakdown and thus remains in river and lake sediments for many years.

Chlordane is a man-made organochlorine compound that was widely used as a broad-spectrum agricultural pesticide before its use was restricted to termite control around building foundations. All uses of chlordane have been banned since April 1988. Chlordane may be introduced to surface waters through contaminated ground water or surface runoff, and is therefore a nonpoint source contaminant. Once in a waterbody, chlordane becomes associated with solids particles and enters the sediments. Fish are exposed to and accumulate PCB and chlordane from the water, through contact with or ingestion of sediments, and in the food they eat.

It should be noted that in the Southwest Region, the configuration of the listed streams (primarily the Allegheny, Monongahela and Ohio Rivers) consists of a series of Locks and Dams. Any PCB contaminated sediments tend to stay in the river pools rather than being washed out as they would be on free flowing streams. All known point source discharges of PCB or Chlordane in the Southwest region have been required to obtain an NPDES permit with water quality based effluent limits and a requirement of “not detectable” for limits lower than detection.

Two methods were employed in order to locate known sources of PCB or chlordane in the Ohio River. First, the Southwest Field Office searched for information on known existing or historical sources that might contribute PCB or chlordane in or upstream from the fish consumption advisory reach. Second, the EPA Permit Compliance System (PCS) database was searched for any major discharge permits containing PCB or chlordane as an effluent limitation. No major dischargers for either compound were found on the PCS.

Prior to 1980, no federal legislation existed which addressed past disposals of hazardous wastes. Therefore, Congress enacted the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) to address the hazards created from past disposals. Sites identified as possible sources of PCBs are to be remediated under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), which is commonly referred to as Superfund. The act deals with environmental response, providing mechanism for reacting to emergency situations and to chronic hazardous material releases. In addition to establishing procedures to prevent and remedy problems, it establishes a system for compensating appropriate individuals and assigning appropriate liability.

CERCLA required the Environmental Protection Agency (EPA) to develop criteria for prioritizing among sites potentially needing remediation. Those sites scoring high enough on the ranking system are included on the National Priorities List (NPL). Only NPL sites are eligible for EPA remedial action. Once a site on the NPL has been selected for remediation, a formal process must be followed to determine and implement appropriate actions. A Remedial Investigation/Feasibility Study (RI/FS) is done first. The conditions at the site must be determined, including the extent of contamination, migration offsite, and potential for human and environmental exposure. A series of specific remediation alternatives must be developed, including specification of costs, technical feasibility, and environmental impacts. Based on the RI/FS, a Record of Decision (ROD) is written by the EPA, which documents and justifies the selection of a particular cleanup option. This process must include substantial public and state participation. Following the ROD, the detailed engineering plans are prepared (the Remedial Design), and implementation (Remedial Action) can begin.

The Superfund Amendments and Reauthorization Act (SARA) of 1986 provided additional guidance for determining "how clean is clean" for the level of removal during a site cleanup. Cleanups must be protective of human health and the environment, be cost-effective, and use permanent solutions, including treatment and resource recovery, as much as practicable. Land disposal is discouraged.

The decision-making framework for the management of sediments has two major components: the remedial investigation and the feasibility study (RI/FS). For a Superfund site with contaminated sediments, the remedial investigation identifies the character of the sediments and the extent of contamination, among other information. The feasibility study includes an evaluation of all reasonable remedial alternatives, including treatment and non-treatment options.

Pennsylvania's Hazardous Sites Cleanup Act (HSCA) was created so that Pennsylvania could effectively fulfill their statutory responsibilities under CERCLA; recover costs incurred fulfilling those statutory responsibilities; and supplement CERCLA by creating a state program for cleanup of sites not included on the National Priorities List.

The following sites are identified as potential non-point sources of PCB to the Ohio River: the Breslube-Penn site, the former H.K. Porter site, the former Allis Chalmers site, the Texas Eastern Holbrook compressor station, and the Ohio River Park Site:

Former H.K. Porter Site

The H.K. Porter site is located in Hopewell Township, Beaver County on Shouse Run (stream code 36638, RMI 0.2 miles). Shouse Run is tributary to the Ohio River at RMI 966.2. PCB concentrations in the soils are documented to be as high as 130 mg/Kg, however no PCBs were detected in Shouse Run. This site is being addressed under the state's HSCA program.

The former H.K. Porter Drum Dump Site is located on approximately 17.5 acres of property situated ¼ mile west of the Ohio River and adjacent to State Route 51 (Rt. 51) in Hopewell

Township, Beaver County, Pennsylvania. One small stream, Shouse Run, transects the property, and is located at the toe of the disposal area, which contained between 1,500 and 2,000 rusted 55-gallon drums containing various hazardous wastes. Analytical results from the associated soils and wastes collected from October 1990 through January 1993 revealed the presence of lead and PCB at elevated concentrations.

In 1991, H.K. Porter excavated approximately 7,875 tons of non-hazardous wastes and 4,260 tons of hazardous wastes from the disposal area. In the late 1990s, DEP conducted additional cleanup activities under HSCA that included the excavation and off-site disposal of approximately 50,000 cubic yards of hazardous waste. DEP then installed a soil cover and revegetated the entire site. Therefore, the site does not represent a source of contaminated soil erosion to Four Mile Run or to the Ohio River.

Breslube-Penn Site

The Breslube-Penn site is located in Coraopolis, Allegheny County, Pennsylvania. The site is situated along Montour Run, which is a tributary to the Ohio River. The facility, identified by EPA identification number PAD089667695, site comprises approximately 11.1 acres and borders Montour Creek. The facility historically operated as a solvent recovery and oil recycling facility and currently is inactive.

Elevated levels of PCB have been found in soil and groundwater at a soil staging area and filter cake area, where soils and filter cake wastes from past remedial activities have been stockpiled on site. Sampling of this pile, which is 90 feet wide, 145 feet long and 30 feet high revealed an average PCB concentration of 52 mg/kg. The site may be an existing source of PCB to the Ohio River through contaminated soil erosion, but there is insufficient data to quantify its contribution.

The Breslube-Penn site is undergoing investigation and cleanup under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The members of the Breslube Joint Steering Committee have entered into an Administrative Order on Consent with the EPA to conduct a Remedial Investigation/Feasibility Study at the site (RI/FS). After approval and implementation of the RI/FS, remediation activities will be implemented.

Former Allis Chalmers Site

The Allis Chalmers site is located in Pittsburgh, Allegheny County on the North Bank of the Ohio River (RMI 979) across from Brunot island. During the 1970s EPA conducted an investigation and it was documented that a 30,000 gallon vault of PCBs was at this site. Based on information provided by EPA, the 30,000 gallon vault of PCB contaminated oil at this site has since been removed, and there is no evidence to suggest this is currently a source of PCB contamination in the Ohio River basin.

Texas Eastern Holbrook Compressor Station

The Texas Eastern Holbrook Compressor Station is located in Richhill Township, Greene County and is covered by NPDES permit PA0216593 in the Ohio River watershed (North Fork of Dunkard Fork Creek at RMI 1.96). This site was an historic nonpoint source of PCBs in the watershed. As a result of a statewide CO&A with Texas Eastern, this site and others were required to remove PCB contaminated soil, and to collect and treat contaminated groundwater. The facility currently discharges treated groundwater to Dunkard Fork Creek, an Ohio River tributary at River Mile 1.96, under National Pollutant Discharge Elimination System NPDES permit No. PA0216593 with "not detectable" limits, and the groundwater is treated with carbon. Because of the remedial actions conducted, the site no longer is a source of PCB contamination in the watershed.

Ohio River Park

This site is located approximately 10 miles downstream of Pittsburgh, Pennsylvania on the western end of Neville Island, which is situated within the Ohio River. This site has a NPL status of final. Remedial actions have been completed under CERCLA and a sports complex has been developed on the site, thereby covering any remaining contaminated soil that could serve as a potential nonpoint source of PCB. Therefore, this site is not a nonpoint source of PCB to the Ohio River.

Atmospheric Deposition: Development of the TMDLs for the Ohio River considers background pollutant contributions. The natural in-stream background concentration of chlordane is assumed to be zero because chlordane is a man-made product and there are no natural sources. PCB is also a man-made product and no natural sources of PCB load exists in the environment. Nonetheless, due to the pervasive use of PCBs prior to their ban in the late 1970s and their slow degradation rates, PCBs are now widespread in the environment. This pervasive distribution of PCBs in air, soil, and water effectively creates a background load of PCB in all water bodies. Atmospheric deposition can contribute to background concentrations of PCB in water bodies.

Atmospheric deposition of PCB plays a dominant role in PCB cycling in many freshwater systems. Monitoring conducted under the Integrated Air Deposition Network (IADN) and the Great Waters Program indicate that wet and dry deposition of PCB can vary greatly both regionally and by season. According to EPA's Lake Michigan Mass Balance (LMMB) Study, atmospheric transport and deposition of PCB provides about 82 percent of the total PCB load to Lake Michigan. Because PCB is no longer produced, the major source of PCB to the atmosphere is volatilization from sites where they have been stored, disposed, or spilled; from incineration of PCB-containing products; and, to a lesser extent, from PCB formation during production processes.

Although analysis predicts that atmospheric deposition may provide a significant source of PCB load to the water body, volatilization from the water column and sediments is likely to result in continuing PCB loss from the water body, thereby reducing, or negating, the atmospheric load. Hillery, et. al., (1998) found that the Great Lakes are currently experiencing a net loss of PCB. In each of the five Great Lakes, the net deposition of PCB is believed to be insignificant because gas transfer out of the lakes counteracts the flow into the lakes from wet and dry deposition. Similar processes are likely to be occurring in Pennsylvania water bodies.

PCB air deposition values specific to Pennsylvania have not been identified. Therefore, no definitive data exists to document this as a source of PCBs to the impaired water.

Driving Directions: from Philadelphia to HK Porter Site:

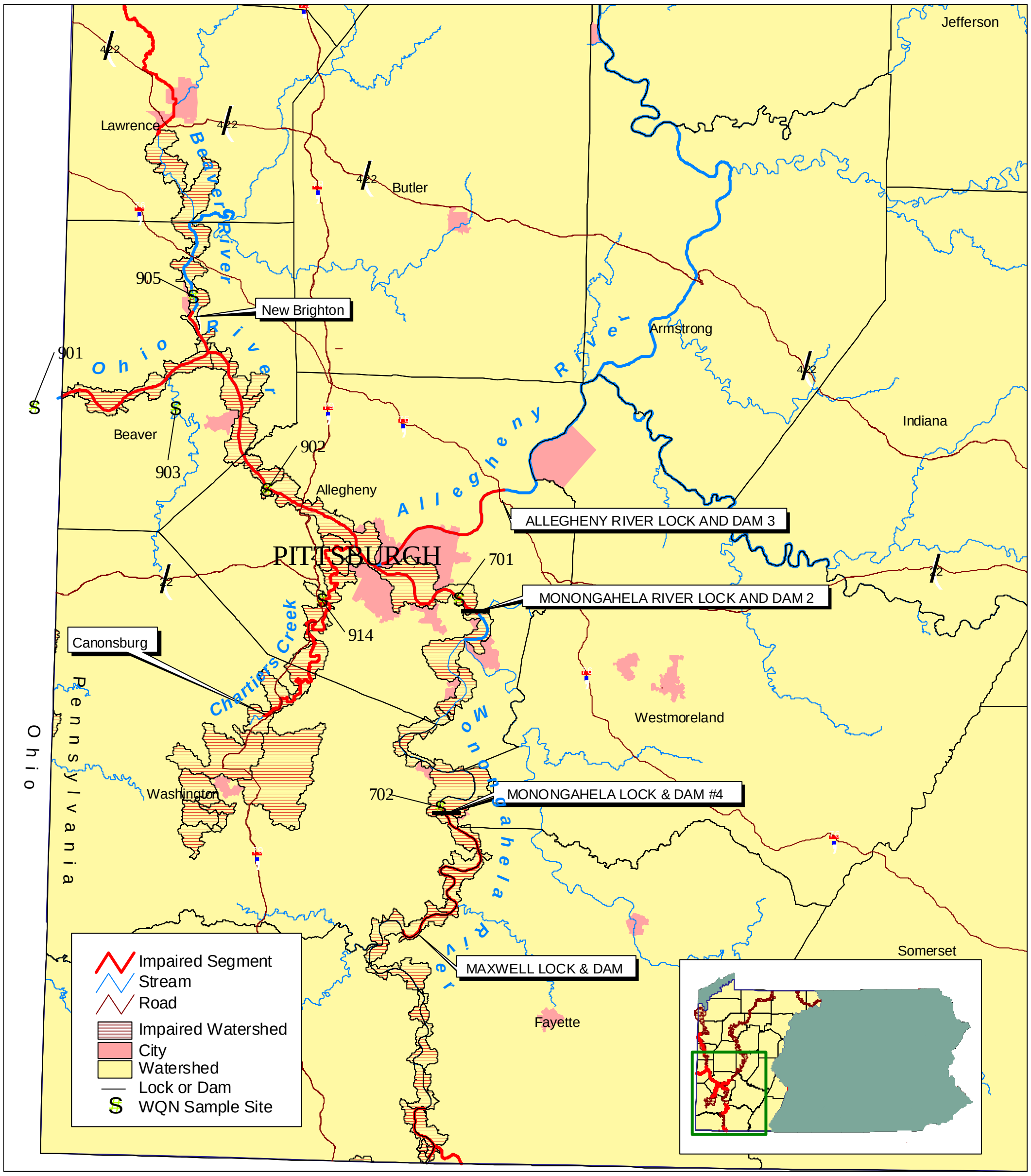
1. Take I-76 West to I-79, Exit No. 3 onto I-79 South
2. Take I-79 South to Exit 17, take Rt 51 North
3. Follow Route 51 North 12.0 miles to the Ambridge Bridge
4. Continue on Rt 51 North.
5. The site is on the left side of route 51 about 1.5 miles north of the Ambridge Bridge

Driving Directions from Philadelphia to Allis Chalmers Site:

1. Take I-76 West to I-79, Exit No. 3
2. Follow I-79 South to Exit 19, and take Rt 65 South about 6 miles
3. The site is on the right

Driving Directions from Philadelphia to Texas Eastern Holbrook Station:

1. Take I-76 West to Exit 8, Take I-70 West
2. Follow I-70 West to I-79
3. Take I-79 South to Exit 3, and get on Rt. 21 West
4. Follow Rt 21 West to Wind Ridge.
5. Stay on Rt 21 West for 1.5 miles past Wind Ridge and turn left at the last road before Ryerson Station.
6. The Compressor Station is about 0.5 miles up this road on the right



TMDL Calculation

Development of TMDLs includes consideration of background pollutant contribution, appropriate and/or critical stream flow, and seasonal variation.

Monitoring for Background Concentrations of PCBs

PCB concentrations in surface waters may be greater than zero in waters where no specific source, either point or nonpoint source, can be identified. Only site-specific data can be used for the TMDL calculations. However, because sufficient data does not exist for this particular waterbody segment that would allow the selection of such a background value for TMDL calculation purposes, a value of zero was used. In order to verify this assumption, or to properly select a background concentration for calculating a TMDL, site-specific water quality monitoring for PCBs may be conducted at this site some time in the future.

If future background sampling were to identify PCB levels greater than zero for this segment, Pennsylvania would review and appropriately revise the TMDL. Currently, there is no approved and widely available analytical method for analyzing water column samples at the ultra low levels at which PCBs may be present. EPA method 1668-A may offer such capability, but is currently only approved for use in analyzing sewage sludge, is very expensive to run and of limited availability.

PCB and chlordane are probable human carcinogens. Carcinogenesis is a nonthreshhold effect, an adverse impact that may occur at any exposure greater than zero. Such an effect is often related to long-term exposure to low levels of a particular chemical or compound, rather than an immediate effect due to a short duration exposure to a high level. As noted earlier, the Department's water quality toxics management program uses a cancer risk level of 1×10^{-6} to protect human health. Attainment of this risk level is predicated on exposure that includes drinking 2 liters of water and ingesting 6.5 grams of fish per day over a 70-year lifetime. The Department uses harmonic mean flow as the appropriate design condition for dealing with exposure to carcinogens. This is a long-term flow condition that will, when applied to the Total Maximum Daily Load, represent long-term average exposure. Because seasonal increases and decreases in concentration are less important than the long-term exposure to a carcinogen, use of harmonic mean flow adequately considers seasonal variations in PCB and chlordane concentrations.

The calculation of the Ohio River TMDLs utilizes the water quality criteria and flow data from the U.S. Geological Survey (USGS) surface water discharge station 11.8 miles downstream from confluence of Allegheny and Monongahela Rivers [03086000]. The harmonic mean flow was calculated using the low flow yield method found in the Department's "Implementation Guidance - Design Stream Flows" (Document No. 391-2000-023, p 4). The Segment Qhm for the Ohio River is 20,500 cfs (based on ORSANCO's Report Appendix B – Critical Flow Values Montgomery Dam to Willow Island Dam.)

The Segment Qhm is used in calculating the Total Daily Maximum Load (TMDL) by multiplying it by the water quality criterion and a multiplier (0.00539) to convert from cfs x ug/L to lbs/day (pounds per day).

The PCB TMDL for the Ohio River is calculated as follows:

20500 cfs x 0.00004 ug/l = 0.82 cfs x ug/l x 0.00539 = 0.00442 lbs/day.

The chlordane TMDL is calculated as follows:

20500 x 0.0005 ug/l = 10.25 cfs x ug/l x 0.00539 = 0.0553 lbs/day.

The Total Maximum Daily Load of PCB for this segment of the Ohio River is 0.00442bs/day.. The chlordane TMDL is 0.0553 lbs/day.

Percent Reduction for Ohio River Basins 20-B, D and G

The goal of this TMDL is to achieve the water quality criteria in order to protect public health. In order to achieve this, the instream concentration must be reduced from the estimated current levels to the criteria. Percent reduction is calculated using the following formula:

% Reduction = (1 - TMDL Goal/ Existing Concentration) x 100.

The percent reduction for PCB is calculated as follows:

% Reduction = (1 - 0.00004/0.04577) x 100
% Reduction = (1 - 0.00087) x 100 = 99.91 %

Percent reduction for chlordane is:

% Reduction = (1 - 0.0005/0.0183) x 100
% Reduction = (1- 0.02732) X 100 = 97.27 %

Overall reductions of 99.9% for PCB and 97.3% for chlordane are needed to achieve the TMDL goal.

Margin of Safety (MOS)

Achievement of the TMDLs will generally ensure achievement of the water quality criteria. To account for uncertainties that may be associated with the TMDL calculations, the Department proposes to hold 10% of the TMDLs in reserve. Applying this 10% margin of safety results in a PCB MOS of 0.000442 lbs/day and the chlordane MOS of 0.005525 lbs/day. The remaining load is available for allocation to all sources for the Ohio River segment.

Wasteload Allocations (WLAs) and Load Allocations (LAs)

There is no data available on PCB or chlordane concentrations upstream of the segment of the Ohio River from Basins 20-B, D and G.

Since the former point sources identified in the Source Assessment Section have ceased operations, there are no known point source discharges of PCBs in the Ohio River watershed other than those identified in the TMDL reports for Chartiers Creek. The NPDES source that was initially identified was Texas Eastern Holbrook Station (PA 0216593) is primarily from treated discharge of PCB contaminated ground water. However, this discharge flows into North Fork Dunkard Creek[Quad: Wind Ridge, PA] to Dunkard Creek to Wheeling North Fork Creek

[Quad: Majorsville, W-VA-PA] to Ohio River. This segment of the Ohio River watershed lies in West Virginia and not in Pennsylvania. Therefore, the PCB load contributed by this point source is not considered. The PCB load is contributed primarily by nonpoint sources and may be introduced to surface water through contaminated ground water, surface run-off, or contaminated sediment. The Source Assessment notes that once in a water body, PCB becomes associated with soil particles and enters the sediments. Fish tissue contamination results from this sediment load.

Because of this and because there is no way to accurately quantify loadings from groundwater or erosion, the entire remaining PCB load of 0.00398 pounds per day is assigned to a Load Allocation for the instream sediment and tributary streams for the Ohio River segment Basins 20 –B, D and G.

Because there are no known point sources of Chlordane to this segment of the Ohio River, it is treated as a nonpoint source contaminant that may be introduced to surface water through contaminated ground water, surface runoff, or contaminated sediment. Chlordane also becomes associated with soil particles and enters the sediments once in a water body. Fish tissue contamination results from this sediment load. Because of this and because there is no way to accurately quantify loadings from groundwater or erosion, the entire TMDL for chlordane for the reach of the Ohio River is assigned to Load Allocation (LA) for the instream sediment. For the Ohio River segment from Basins 20-B, D and G, the chlordane Load Allocation (LA) is 0.04973 pounds per day.

TMDL Summary

The TMDLs for the Ohio River segment from Basins 20-B, D and G can be summarized as follows:

Ohio River From Basins 20-B, D and G				
Pollutant	**TMDL (lbs/day)**	**WLA (lbs/day)**	**LA (lbs/day)**	**MOS (lbs/day)**
PCBs	0.00442	0.0	0.00398	0.000442
Chlordane	0.0553	0.0	0.0497	0.00553

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TMDL Verification

The stated goal of this TMDL is to meet the PCB and chlordane water quality criteria for the protection of public health in this reach of the Ohio River. Another way to state the goal is to reach a point where fish consumption advisories are no longer needed because tissue levels of PCB and chlordane are no longer above the levels of concern.

The three agencies involved with the issuance of fish consumption advisories in Pennsylvania currently apply the "Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory" (commonly referred to as the Great Lakes protocol) for issuance of consumption advisories due to PCB. Following this method, meal-specific consumption advice is issued by species. The first level of consumption advice, eat no more than one meal per week, is issued when the tissue PCB concentration is 0.06 to 0.20 mg/kg. The upper limit for unrestricted consumption is 0.05 mg/kg. In order to verify the level of protection the PCB TMDL would provide, the estimated fish tissue concentration expected to accumulate at a water column concentration of 0.00004 ug/L was calculated. Reaching the PCB criterion would result in an estimated tissue concentration of 0.001 mg/kg, well below the 0.05 mg/kg level for unrestricted consumption.

Pennsylvania currently uses the U.S. Food and Drug Administration (FDA) Action Level of 0.3 mg/kg for issuance of advisories due to chlordane contamination. Achievement of the chlordane water quality criterion of 0.0005 ug/l would result in an estimated fish tissue concentration of 0.007 mg/kg, much lower than the Action Level. The consumption advisory could be lifted at that level.

This TMDL analysis estimates, based on back calculations from fish tissue concentration, that the concentration of PCBs in the receiving water exceeds water quality standards~~s~~. The TMDL analysis also shows that the existing loads of PCBs need to be reduced. The source analysis identifies various sources of this contamination including Breslube-Penn, a Superfund site. For this TMDL and the specific superfund site identified, it was assumed that controls associated with remediation of the identified sites will result in the removal of the pathway that is associated with sediment loading to the water. This elimination of the surface runoff and sediment loading pathway may reduce the associated runoff of soil-bound PCBs.

The TMDL focuses on the amount of PCBs that the water body can receive and still maintain water quality standards while the Superfund/CERLA programs focus on meeting environmental goals by eliminating the pathways of exposure of pollutants. Together, these programs can meet the allocations/goals set in this TMDL. The collaboration of the Superfund program and the TMDL program to address the impacts of legacy pollutants, such as PCBs, is the next step in an on-going and complex process of meeting water quality standards through the remediation of contaminated sediments. The integration of two often-separate programs is necessary in situations such as this where a land-based source contributes to the contamination of a waterbody. The goal of the TMDL is to reduce PCBs in the water column to water quality standards levels. This is separate from the Superfund goal which is to eliminate the pathway of contamination and not necessarily the elimination of the pollutant. Superfund balances remediation with risk determinations of human health and feasability. The TMDL program does not - it is absolute in its goal to meet standards.

A TMDL is a planning tool that may change over time as the data improves and the watersheds change. As additional data are collected the identified sources of PCBs are confirmed, a determination will be made as to whether this new data is significant and a TMDL revision is necessary. In some instances the final decision on remediation methods at the Superfund sites have not yet been made. While it is expected that this TMDL will serve as a decision tool for those remediation plans, it may be found that the removal of the sediment/runoff pathway may not be feasible or acceptable for other reasons. If this should be the case, the TMDL would be reopened and the allocations re-distributed, but still meeting the total allowable load from all sources, to take into consideration the final remediation plan. However, it is important at this time to provide a goal that is based on the need to meet water quality standards to serve as a focal point for site plan development.

Recommendations

The use of both PCB and chlordane has been banned in the United States, so there should be no new point sources to which controls can be applied. There are no known additional sources of PCB and chlordane to the Ohio River segment other than the ones identified above. PCB and chlordane present in the main stem of Ohio River are believed to reside primarily in the sediment due to historical use and improper disposal practices.

Generally, the levels of PCB and chlordane are expected to decline over time due to the bans on use through natural attenuation. Examples of processes in natural attenuation are covering of contaminated sediments with newer, less contaminated materials, and flushing of sediments during periods of high stream flow.

Natural attenuation may be the best implementation method because it involves less habitat disturbance/destruction then active removal of contaminated sediments. Mechanical or vacuum dredging removes the habitat needed by certain benthic macroinvertebrates. In addition some of these organisms will be killed during the dredging process. Suspension of sediments during dredging may also cause abrasive damage to the gills and/or sensory organs of benthic macroinvertebrates or the gills of fish. Suspended sediments can also affect the prey gathering ability of sight-feeding fish. In addition, active removal may cause resuspension of contaminated materials thus making PCB and chlordane available for additional uptake. This alternative is also the least costly option.

For the Ohio River segment outlined above, long-term natural attenuation is the best alternative. This approach provides reasonable assurance that the TMDL will be implemented.

More than ten Federal statutes provide authority to many EPA program offices to address the problem of contaminated sediment. These statutes include: the National Environmental Policy Act; the Clean Air Act; the Coastal Zone Management Act; the Federal Insecticide, Fungicide, and Rodenticide Act; the Marine Protection, Research, and Sanctuaries Act; the Resource Conservation and Recovery Act; the Toxic Substances Control Act; the Clean Water Act; the Great Lakes Water Quality Agreement of 1978, and the Comprehensive Emergency Response, Compensation, and Liability Act. These statutes do not include any type of sediment criteria or a cleanup standard for PCBs or chlordane. Therefore, a determination on whether to conduct remediation of contaminated sediments is not as simple as comparing the sediment concentration to a criteria or standard. Generally, areas with sediment concentrations of PCB of 50 ppm or greater are considered areas of high concentration or “hot spots” and are actively remediated.

EPA's <u>Contaminated Sediment Management Strategy</u> (CSMS), indicates, "Widespread, low levels of contaminants may favor natural attenuation, while geographically limited areas containing high levels of contaminants favor active remediation." Natural attenuation may include natural processes that can reduce or degrade the concentration of contaminants in the environment including biodegradation, dispersion, dilution, sorption, volatilization, and chemical or biologic stabilization, transformation or destruction of contaminants, and the deposition of clean sediments to diminish risks associated with the site.

There are no known sediment data for the advisory portion of the receiving stream. With the ban on the production of chlordane and PCBs, the mitigation of there release into the environment as the result of the remedial actions being conducted, and the continued natural attenuation that is occurring in the receiving stream, it is believed the criteria for these pollutants in the water column will eventually be achieved and the goal of the TMDL for the receiving stream to be "fishable" will be met.

<u>Monitoring</u>

Pennsylvania will continue to monitor PCB and chlordane in fish from this reach of the Ohio River. Samples will be collected once every five years. The data will be used to evaluate the possible threat to public health and to determine progress toward meeting the TMDL. The consumption advisories will remain in place until the water quality criteria are achieved and advisories are no longer needed.

<u>Public Participation</u>

Notice of the draft TMDL for the Ohio River was published in the *Pittsburgh Post-Gazette*, a daily newspaper of approximately 1.2 million readers, on Friday October 6, 2000 (Section-Classifications 444 to 479) and in the PA Bulletin on September 29, 2000. A public meeting was held on November 14, 2000 at DEP's Southwest Regional Office, located at 400 Waterfront Drive, Pittsburgh, PA 15222 (Waterfront Rooms A & B) to discuss and accept comments on the proposed TMDL. The public comment period closed on November 29, 2000.

At the public meeting four people showed up. They were form the Army Corps of Engineers, a local watershed group and a USX attorney. Primarily, the following concerns were noted in our discussions:

a) Will the State be responsible for cleaning up the PCBs in the river sediment if "natural attenuation" approach is not acceptable?
b) How long will "natural attenuation" take in order to reduce PCBs to acceptable levels?
c) Will industries be required by EPA to sample for soils and groundwater to find any unknown existing sources of PCBs?

Additionally, "Friends of the Riverfront" furnished written comments on 11/28/00. their comments applied to Shenango River, Beaver River, Chartiers/Little Chartiers Creek, Monongahela River and the Ohio River. Their comments centered on "implementation" issues of the TMDLs. These comments were addressed. Please refer to Appendix B for a copy of the letter and the response.

The Department considered all comments in developing the final TMDL, which is submitted to the Environmental Protection Agency (EPA) for approval. Notice of final TMDL approval will be posted on the Department website.

Appendix B

COMMENT AND RESPONSE ON THE PROPOSED PCB/CHLORDANE TMDL FOR THE OHIO RIVER

EPA Region III

Comment: General: The report notes that the major fate process for PCBs and chlordane is adsorption to soil and sediment organic matter. However, only contaminants moving to lower layers of the sediment may be effectively sequestered. Otherwise, the sediments may act as an environmental reservoir, and any hydrologic processes that disturb or scour sediments also act to redistribute contaminants. The dam structures should be included in the TMDL analysis as they may act to trap the majority of sediments from reaching the downstream impaired segments of the Ohio River. In addition, given that volatilization is a significant environmental transport process for dissolved PCBs, the presence of a dam or other feature that may increase aeration rates could act to decrease PCBs in the water column prior to the impaired segment.

Response: The comment suggests that instream concentrations of the contaminants may be less than expected because of possible resuspension in the water column and volatilization. There are no data to adequately characterize the water column concentrations and the TMDL states that estimating from fish tissue concentrations (as was done) likely over-estimates the water concentration. Because movement of the fish is prohibited to upstream of the dam, there is no reason to address concentrations of PCB or chlordane (even if there were data) that may exist above the dam.

Comment: TMDL Development/Endpoint Identification: PA DEP found that insufficient STORET data were available within a five-mile radius of the fish tissue sampling stations to estimate water column concentrations for PCBs or chlordane. The TMDL should specify whether PA DEP searched for STORET data in any other portions of the listed segment to support the water column concentration estimates. Also, the TMDL should specify the analytical detection limit for those results that were reported as less than detection and whether the analytical results were only for PCBs.

Response: The STORET search was designed to be representative of the fish advisory segment, and was intended to supplement the file search conducted by the Southwest Field Office. For the Ohio River, the search was conducted using a six-mile radius around Water Quality Network Station 902 and a 15-mile radius around the fish tissue sampling station just below the Montgomery Lock and Dam. The report has been revised to reflect this search, rather than stating that a five-mile radius was used in both instances. The data found were from 1970, 1977 and 1979. The STORET retrieval request included both PCB and chlordane. Only one detection, for PCB, was found and noted in the report to document the search. As noted, this data is not representative of current water quality conditions. Therefore, the detection limits are not relevant.

Comment: <u>TMDL Development/Endpoint Identification:</u> A table shows the range of years and the years of available fish tissue data for PCBs and chlordane in various fish species. Because the time frame is over ten years, the data may show a decreasing trend. An attempt should be made to evaluate time trending of PCB and chlordane levels in fish tissue.

Response: The Department does not believe trend information based on the limited sampling results would be meaningful in this TMDL document. The important factor is that fish consumption advisories are in place and the estimated water column concentrations exceed the criteria. This means that a TMDL must be developed.

Comment: <u>TMDL Development/Endpoint Identification:</u> The table also shows that the number of data sets are either the same or more than the number of years, suggesting that in one or more of the years listed, two or more sets of analytical data are available. The table should be modified to reflect the exact number of data sets available for each listed year followed by an explanation of how the tissue data was used to arrive at the arrive at the estimated water column concentrations.

Please consider listing the fish tissue data that were used to back-calculate the instream water concentration of PCBs or chlordane. This would help clarify whether the tissue concentrations were determined by averaging all data for both carp and channel catfish for each of the years identified. Did the state observe any changes in fish tissue concentrations from 1985 through 1997 that would support natural attenuation as the best alternative for the TMDL?

Response: Average PCB and chlordane tissue levels were determined for each species using all samples. An estimated water column concentration was then calculated for each compound for each species. These estimated water column concentrations were averaged for each compound in order to provide a single estimated water column concentration for each parameter for the segment. The report has been revised to include this explanation. A listing of the fish tissue data is included in the final TMDL as Appendix A. The back-calculation was done to provide an estimated water column concentration for comparison to the water quality criteria because no current data are available. The important point for the TMDL is that the data show the criteria are most likely exceeded making a TMDL necessary.

The Department does not believe trend information based on the limited sampling results would be meaningful in this TMDL document.

Comment: <u>Source Assessment:</u> PA DEP indicates that known point sources of PCBs or chlordane must obtain an NPDES permit, but does not identify these potential sources. The report notes that several potential nonpoint sources have been identified, but they are not listed. Furthermore, the report states that no data are available to quantify the potential nonpoint source loads. Non-detect readings for effluent, soil or ground water samples may not be sufficient to omit point or nonpoint sources from the TMDL analysis. Current testing techniques lack the precision necessary to accurately quantify levels that could ensure compliance with the water quality criteria for PCBs. If the point sources can demonstrate they are no longer accepting any discharge potentially containing PCBs or chlordane, their removal from the TMDL can be justified. Otherwise, the TMDL analysis and allocation should be revisited to consider the impact of point sources. Also, the relevance of the statewide ground water and soil loading standards to the TMDL is not clear. They should have no effect on the assessment of attainment of the PCB or chlordane criteria.

Response: The report states in at least two places that there are no known point sources of PCBs or chlordane. Non-detect readings are the readily available data supporting the TMDL. In the absence of data, it is not correct to assume non-compliance with water quality standards and attempt to refine allocations.

Comment: A search of potential sites undergoing remediation under CERCLA, SARA TSCA or Pennsylvania's Hazardous Site Cleanup Act (HSCA) should be conducted to locate potential PCB or chlordane sources.

Response: The Department acknowledges EPA's assistance in looking for additional data, and added appropriate discussion in the Source Assessment section.

Comment: <u>Source Assessment:</u> This section provides a summary of CERCLA, SARA and HSCA in an apparent attempt to define the programs under which sediment remediation could occur. The TMDL implementation, however, relies on natural attenuation, so these discussions do not appear to be relevant.

Response: The discussions have been deleted as irrelevant.

Comment: <u>Source Assessment:</u> The report states, "Appropriate level of cleanup is difficult to determine. Removal of all contaminates is virtually impossible and exceedingly expensive. However, cleaning up to any other level raises issues of dose response, which links an amount of a contaminate to the resultant effect, which is difficult to accurately predict." The word "contaminate" is used here instead of "contaminant." The entire paragraph should be clarified, and may not be appropriate for this section.

Response: The paragraph has been deleted.

Comment: <u>Wasteload Allocations and Load Allocations:</u> Because there are three sites contaminated with PCBs, it is not sufficient to simply allocate to instream sediments given that theses are current or former nonpoint sources of PCBs. EPA recently assisted DEP in developing a PCB TMDL for Valley Creek that serves as a useful example of how to allocate when such sites are identified. The TMDL should be revised and PA DEP should contact applicable state/Federal agency personnel involved in the three sites. If possible, an approach similar to Valley Creek should be used. This approach is predicated on the existence of remedial actions that will ensure that sources of PCB contamination (land-based contaminated soil runoff or instream sediments) will be controlled so that applicable water quality standards will be attained and maintained. If not, PA DEP must allocate to each of the three land-based sources as well as instream sediments. That allocation method must be scientifically defensible.

Response: DEP thanks EPA for providing the resources to gather additional file and literature data that allowed for increasing the information in the Source Assessment. Allocation to the potential sources was not made because there is limited information to use in such determinations.

Comment: <u>TMDL Implementation:</u> Implementation relies on natural attenuation of the contaminated sediment. Existing fish tissue or sediment data demonstrating that this process is ongoing would support the reasonable assurance section of this TMDL.

Response: The Department used existing and readily available and has revised the TMDL where appropriate.

Comment: <u>Sediment Remediation:</u> This section provides background information on the federal statutes and regulations that address sediment contamination and appears to have been pasted from another document without editing. This section should be revised to include only information relevant to this TMDL. The document indicates that a number of "criteria have been evaluated in order to determine the appropriate remedial actions for the four sites of concern." Throughout the TMDL, there is no mention or description of any four specific sites of concern.

Response: The Department agrees and has revised the TMDL accordingly.

Comment: <u>Sediment Remediation:</u> The last paragraph states that there are no known "hot spots" in the advisory segment where sediment samples exceed 50 mg/kg. This suggests that sediment samples have been collected, but there is no mention of such sampling throughout the document.

Response: There are no known sediment data for the advisory portion of the receiving stream and the report is revised to state that.

Comment: <u>Monitoring:</u> This section states that fish tissue monitoring will continue once every five years. First, other EPA-approved for comment TMDLs include monitoring of fish tissue every two years. Secondly, this section does not specify which fish species will be monitored and for what parameters. Last, given that this TMDL segment is about 39.6 miles in length with several tributaries, the monitoring will require multiple locations. A consolidated fish tissue monitoring program for the whole Ohio river watershed may be appropriate.

Response: Pennsylvania's fish tissue monitoring program is generally based on a five-year sampling rotation. Two particular streams, currently under No Kill regulations, are monitored every two years. This TMDL is for PCB and chlordane. Both of these compounds are included in the parameter list for the Department's routine monitoring program. Any monitoring will attempt to target the species for which consumption advisories are in place, although obtaining target species is not always possible.

Appendix C

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